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MERCURY MerCruiser

2005
Product Update

Section 1

Fuel Systems

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496 Mag & 8.1S Calibrations that Reduce the Amount of Soot Produced

There have been complaints of MCM 496 MAG and MIE 8.1s units, both Base and H.O., causing soot deposits on boats. A new calibration has been released that significantly reduces the amount of soot produced. These calibrations will be available through P&A in replacement PCM's.

Whether, or not, a boat will develop soot deposits is very much dependent on the boat design, especially the exhaust locations and transom configuration. Boats with molded swim platforms with thru-transom exhaust exiting below the swim platform, are most likely to experience sooting. This is because a low pressure area develops beneath the swim platform, when the boat is moving, which holds the exhaust in this area and allows it to settle on the boat surfaces. This "station wagon" effect in some boats has also caused soot to settle on the top side of the swim platform, on the engine cover/sun deck and on other surfaces. If a customer's boat, with a 496 Mag/8.1S engine, has this problem then contact MerCruiser Service.

The next page shows the before and after view of a boat that had this sooting problem. The calibration change made a 70-80% improvement in this condition.

It is recommend to use a cleaning product called Castrol Super Clean when cleaning the boat. Some cleaning products, such as wax and PowerTune, leave a residue that promotes the formation of soot deposits. Castrol Super Clean has been found to not leave such a residue, and will remove the residue left by previous cleaning products.

496/8.1 Engine Soot Update

- A twin 496/8.1L HO in a 33 Foot Boat, after 15 minutes at WOT.

Old Cal

New Cal

Mercury MerCruiser Engine Emission Regulations Changes Effective January 1, 2003.

The changes that become effective January 1, 2003, regarding emission regulations, pertain to all Mercury MerCruiser gas Sterndrives, Inboards and Tow Sports models, as well as the Scorpion 377 and HP500 EFI Racing Sterndrive (hereafter referred to as MerCruiser engines) certified to California emissions standards.

All MerCruiser engines (500 hp and below) with a production date of January 1, 2003, or later are factory-certified to meet the California Air Resources Board's (CARB) 2003 exhaust emission standards. Each factory-certified engine includes a Consumer Information Hang Tag and two California three-star labels, one on the engine and one with instructions for proper installation by the boat builder on MerCruiser-powered boats. The star label is required by the State of California to be affixed to the hull per their guidelines.

Dealers in CA, AZ, NV and OR received further information found below:

Please note that MerCruiser engines built prior to January 1, 2003 do not require CARB certification and may be sold without restriction. Specifically, MerCruiser engines in your inventory that were built prior to the effective date do not require certification (three-star label) and may be sold in California. Also note that the HP900 SC Dry-Sump, HP575 SCi and the HP525 EFI Mercury Racing Sterndrive engines do not require certification and may be sold in California.

The length of warranty coverage on certain components considered as emissions related components by California CARB certification is also different.

All carburetors on 3.0L, 4.3L, 5.0L and 5.7L engines, boxed after 1.Jan 2003, have a sealed idle mixture screw.

The idle mixture screw adjustment is strictly regulated by CARB. However, if the carburetor is overhauled, CARB allows the adjustment of the mixture screw back to original specifications. The idle mixture screw is located under the sealed cap. After the overhaul, install a new Tamper Proof Idle Mixture Screw Kit, leaving the cap off. Adjust the idle mixture screw back to the original factory specified 'turns out' (see reference list below), then install the tamper proof sealing cap.

NOTE: Access to the idle mixture screw can only be made by removing the seal. The sealing cap can be removed by carefully cutting both sides of the outer seal. Use a screwdriver to pry the outer seal apart at the cuts until you can get the cap out. It is recommended that additional Tamper Proof Idle Mixture Screw Kits be ordered for stock because the original seal will be damaged during the removal process.

P/N 3302-803930 Tamper Proof Idle Mixture Screw Kit. (Kit includes a new idle mixture screw, spring, seal cup and seal cap).

3.0L: P/N 3310-864940A01 w/sealed idle mixture screw:	Screw set at 1-1/2 turns out.
4.3L: P/N 3310-864941A01 w/sealed idle mixture screw:	Screw set at 1-1/4 turns out.
5.0L: P/N 3310-864942A01 w/sealed idle mixture screw:	Screw set at 1-1/2 turns out.
5.7L: P/N 3310-864943A01 w/sealed idle mixture screw:	Screw set at 1-1/2 turns out.

NOTE: The carburetor P/N listed is the complete replacement service carburetor that must be used on engines built after January 1, 2003.

MerCruiser U.S. advertised engine power rating

Also, effective January 1, 2003 MerCruiser U.S. advertised engine power rating will be based on crankshaft rather than propshaft measurement. We will continue to use the same SAE J1228/ISO 3046 rating protocol that we use now, which allows for either form of rating. The rated horsepower will not change from the current values since both methods of rating may yield similar values within the tolerances specified by the standard. Unlike outboards, a MerCruiser engine may be associated with a number of transmission devices and the propshaft power will vary depending on the specific type of transmission involved. By rating power at the crankshaft, Mercury better defines for customers the engine that powers their vessel, regardless of the nature of the specific propulsion system involved.

This new hp rating location is in all new owner's manuals and consumer literature.

2002 Built Carbureted Engines with Sealed Idle Mixture Screws.

Because of the labor strike on the West Coast of the USA last year, shipments of MerCarbs for the 2002 3.0L and 4.3L were delayed. To fill engine orders during this time period, the engines listed below were assembled with a California CARB carburetor on them. This carburetor has a sealed idle mixture screw. If the dealer needs to check the idle mixture screw setting, the seal will have to be cut off. In most cases, the 3.0L MerCarb will not have to be removed. The V6 MerCarb will have to be removed from the engine to cut the seal off.

The sealing cap can be removed by carefully cutting both sides of the outer seal. Use a screwdriver to pry the outer seal apart at the cuts until you can get the cap out.

Because these engines were built in 2002, the seal does not have to be reinstalled. If the idle mixture screw is damaged during the removal of the seal, install a new idle mixture screw.

2002 Engines with sealed California CARB carburetors on them:

3.0L: S/N 0M382941- 0M3845400 built 11-21-2002.
S/N 0M384660 - 0M384960 built 12-5-2002.

4.3L: 0M620455 - 0M622544 built 11-22-2002.

MERCURY MerCruiser

Service Bulletin

☑ Warranty Information ☐ Service Information Bulletin No. 2004-01
☐ Parts Information

Circulate to: ☐ Sales Manager ☐ Accounting ☑ Service Manager ☑ Technician ☐ Parts Manager

Electric Fuel Pump Troubleshooting

Models Affected

All MerCruiser V6 and V8 carburetor, EFI and MPI gas engines.

Situation

Mercury MerCruiser receives electric fuel pumps returned for warranty that function properly when tested (No Trouble Found).

Engines that are not run for extended periods of time or are placed in storage with untreated fuel are at risk of forming fuel gum. The accumulation of fuel gum can seize electric fuel pumps, which typically results in the replacement of a mechanically sound fuel pump.

NOTE: *Boost pumps used on EFI or MPI models are the same low pressure pump used on carbureted models. The pumps used to pressurize the EFI or MPI system is a high pressure pump.*

IMPORTANT: Electric fuel pump can be run dry for 10 seconds. Do not run the pump dry repeatedly or internal damage may occur.

A lot can be learned by putting your hand on the fuel pump when voltage is applied to the pump.

1. If the pump does not run but feels like a solenoid closing when battery voltage is applied, it is locked up. In most cases, the pump is locked up because of fuel gum and can be freed by doing the following.
   a. Leave the pump full of a mixture of fresh gasoline and Fuel System Treatment and Stabilizer overnight.
   b. Use mixture as outlined in the fogging procedure in MerCruiser Service Bulletin 2001-15.

IMPORTANT: Do not use the FSTS concentrate when doing this. Other fuel system components that may be gummed up should be treated with this same mixture.

   c. Use 29 ml (1 fl. oz.) of the FSTS per 3.7 L (1 US gal) of fuel for the next 75.7 L (20 US gal) of fuel used in the engine.

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NOTE: *On low pressure boost or carburetor fuel pumps, plugging the outlet, and then running the pump against this blockage for a short time can loosen the stuck internal check valve.*

2. If the pump runs but feels like a rough ball bearing when battery voltage is applied, it more than likely has an internal problem and needs to be replaced. A normal pump running will not feel "rough". The low pressure pump has less vibration to it than the high pressure pump.
3. If the pump does not run at all when battery voltage is applied, check for battery voltage at the pump. Check the following.

NOTE: *Use the wiring diagrams, pressure gauge connections and observe all Warnings and Cautions as outlined in the Service Manual for the engine being worked on. Items listed below may not apply to the engine that you are working on.*

- *Ignition key, cannon plug connector corrosion, loose connection at 50A circuit breaker, blown fuse, etc.*
- *Check fuel pump electric harness connector. The pump needs good positive and ground connection.*
- *Fuel pump relay (EFI or MPI models).*
- *Oil pressure switch (carb models).*

4. If the pump runs when battery voltage is applied, check fuel pump pressure. Connect a service test fuel gauge to the location outlined in the Service Manual. On MPI engine, a Schrader valve is provided for this purpose. On EFI (TBI) models and carbureted models, a test Tee-fitting is required to connect the test gauge. Compare pressure reading to the specifications listed in the Service Manual.

If the pressure is higher than specifications:

- The pump’s internal check valve may be stuck from fuel gum.
- A defective fuel pressure regulator (EFI or MPI models).
- Check for a pinched or plugged hose going to fuel pressure regulator (EFI or MPI models).

If the pressure is lower than specifications:

- Low battery voltage to the pump.
- Fuel tank pickup, fuel tank vent hose, fuel filter or fuel line restriction.
- Faulty anti-siphon valve.
- Air leak somewhere in boat’s fuel line.
- Vapor locking.
- Faulty fuel pressure regulator (EFI or MPI models).

NOTE: *Refer to MerCruiser Service Bulletins 1998-04, 1998-05, 1999-07, 1999-08 and 2001-04 for additional information concerning electric fuel pumps.*

Warranty

Any electric fuel pumps returned to Mercury MerCruiser for warranty and found to function properly (No Trouble Found) may be subject to claim denial and parts returned to the dealer.

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Quad-Rings and O-Rings for Fuel Pressure Gauge Schrader Valve Adaptor Kit, P/N 91-803135.

The following is a list of replacement sealing components for this Adaptor Kit.

Qty.	Snap-On P/N	Description
1	8-4814	Quad-Ring for GM style schrader valve adaptor.
1	8-4914	Quad-Ring for MC (Ford) style schrader valve adaptor.
2	8-4614	O-Ring, 1 ea. for GM and MerCruiser (Ford) style schrader valves.

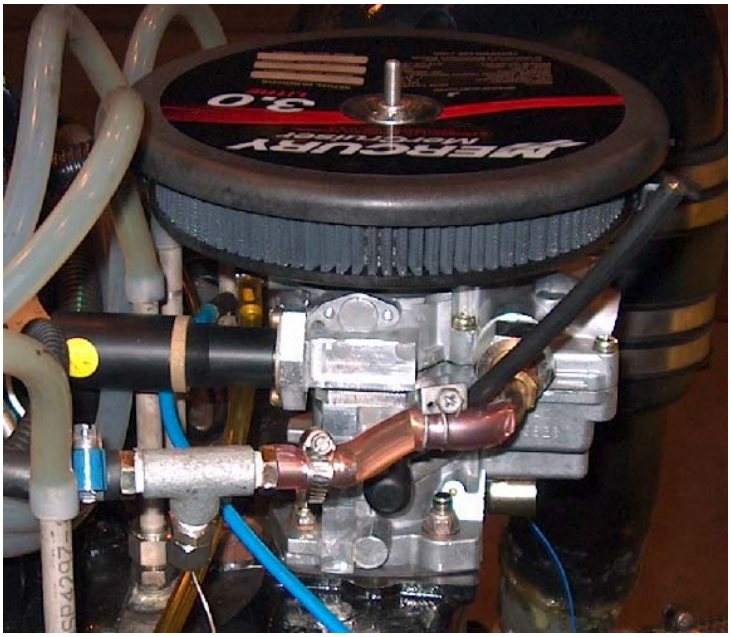
Mercury Parts does not stock these replacement quad-rings or o-rings. Please order them directly from your local Snap-On Tool supplier.

Turn Key Start (TKS) System

- This system will be installed on all carbureted engines. Production start will be during August through October of 2004.

- **Basic Design:**

  - Additional fuel is required during engine starting and warm up.
  - The new design began with the current casting and components similar to carbureted outboard.
  - The casting was modified adding an additional fuel flow path for the TKS module.
  - The TKS flow path is normally open and closes using a heat expanding device coupled to a needle/seat. This device closes the additional fuel flow path after receiving 12 Vdc for 6-10 minutes.
  - The engine will run at an elevated RPM (900 – 1,000) for the 6-10 minutes and then return to the normal idle speed.



Carburetor with TKS

- **Operation:**

  - The new carburetor operates in a manner very similar to the previous MerCarb units, but now has the added benefit of having an additional amount of fuel automatically provided to the engine during cold starts. Pumping the throttle twice before starting the engine is no longer necessary. You just turn the key to start the engine.

- TKS fuel path is in the normally open position. Electric power causes a wax expanding device to expand thus causing the needle to meet the seat and close the additional TKS fuel path.

- **Electric Paths:**

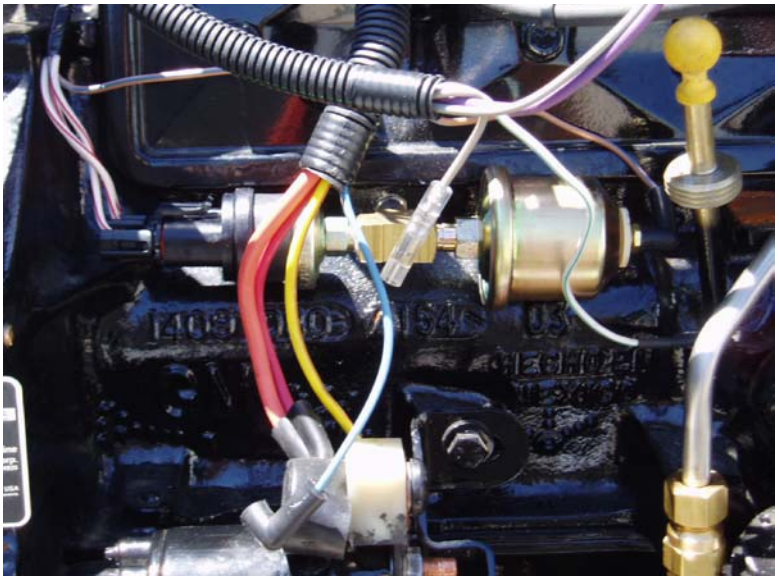
  - There are two paths for electricity to get to the module: one via an additional oil pressure switch and one via an additional engine coolant switch.

  - Additional Oil Pressure Switch:

    An oil pressure switch is added to the system using a “T” fitting. One lead is wired into the purple wire in the harness, the other to the TKS unit.

    When oil pressure exceeds 4psi (i.e. engine running) the oil pressure switch closes sending power to the TKS unit. This begins heating the element and causing closure within 6-10 minutes.

    Power will continue to flow to the TKS unit as long as there is power on the purple wire and there is oil pressure. Thus, if the key is left in the run position, with the engine not running, the TKS unit will not receive power.



Oil Pressure Switch

- Additional Coolant Temperature Switch:

A second switch has been added to the system and it is located in a new thermostat housing on the 3.0L models and in the intake manifold coolant passage on V6 and Small Block V8 models.

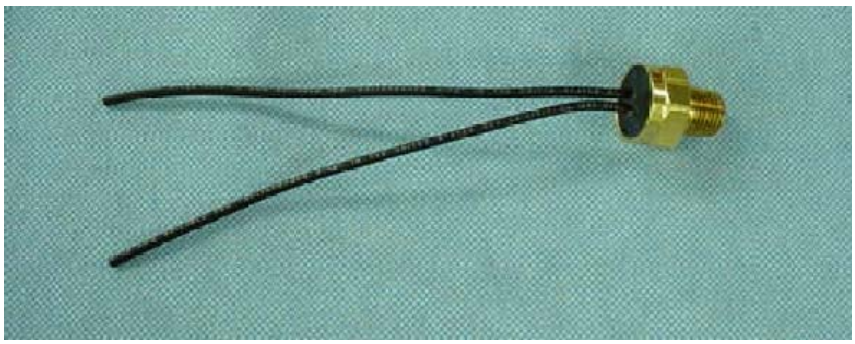
This switch is used to keep the TKS unit from opening (when the engine is warm), which prevents additional fuel from entering the engine under hot re-start conditions.

One lead is wired to the circuit breaker (i.e. battery power via an in-line fuse) and the other lead is wired to the TKS unit. This switch is normally open and closes (completing the circuit) above 130 degrees F.

When the engine coolant temperature reaches 130 degrees F, the coolant temperature switch closes and remains closed until the coolant (or sea water on sea/raw water cooled engines) temperature drops below 110 degrees F. When closed, the switch sends 12Vdc to the TKS Module, thus keeping the additional fuel flow path closed until the engine cools sufficiently to warrant the additional starting fuel.

Once the coolant temperature drops below 110 deg F. the coolant temperature switch opens and the 12Vdc is no longer sent to the TKS module. The TKS unit will cool allowing the needle to back off the seat and aid in the next starting event.

The wiring harness will be equipped with a diode to prevent power from this source running back on the purple lead, which would keep the engine running after a commanded stop.



Coolant Temperature Switch

- **Troubleshooting and Repair:**

  - The TKS system has very few repair parts:

    The TKS Module
    The oil pressure switch
    The coolant temperature switch and diode

TKS Module

- There are essentially three failure modes:

Hard Starting – Cold

In this mode, the TKS fuel path is closed. As the module is normally open, there are 3 possible root causes:

- Continuous power is getting to the TKS module
- Debris in the TKS fuel path
- The TKS module has failed

Hard Starting – Hot

In this mode, the TKS fuel path is open. As the module is normally open, there are two possible root causes:

- Continuous power is not getting to the TKS module
- The TKS module has failed

Poor running/running rich/excessive fuel consumption

- In this mode, the TKS fuel path is open and the causes are the same as Hard Starting – Hot.

- **TKS Retro Fit Kit**

  - Retro Fit Kits will be available for all engine lines, at the end of the year (2004):

    3.0 L 1996 – 2004
    4.3 L 1998 – 2004
    5.0 L 1998 – 2004
    5.7 L 1998 – 2004

  - Anti-Dieseling Kits are **not compatible** with TKS carburetors or Retro Fit Kits.

  - Each kit will come with some, or all of the components shown below (depending on engine model) that are necessary for installation:

    - TKS Carburetor w/ mounting gasket
    - Oil pressure switch with fittings
    - Coolant temperature switch with fittings
    - New thermostat housing
    - Engine harness jumper
    - Flexible fuel line
    - Installation Instructions

MEFI III to IV Conversion Kits

- Project Objectives
  - Provide long term resolution to availability issues with MEFI III ECM
  - Prioritize highest volume service ECMs for conversion
  - started in 2004 season

MEFI III to IV Conversion Kits

- System Overview
  - MEFI IV ECM which physically appears the same as a MEFI III
    - Pin out locations are different
    - Coil driver is not internal
  - Calibrations have been directly converted into MEFI IV code

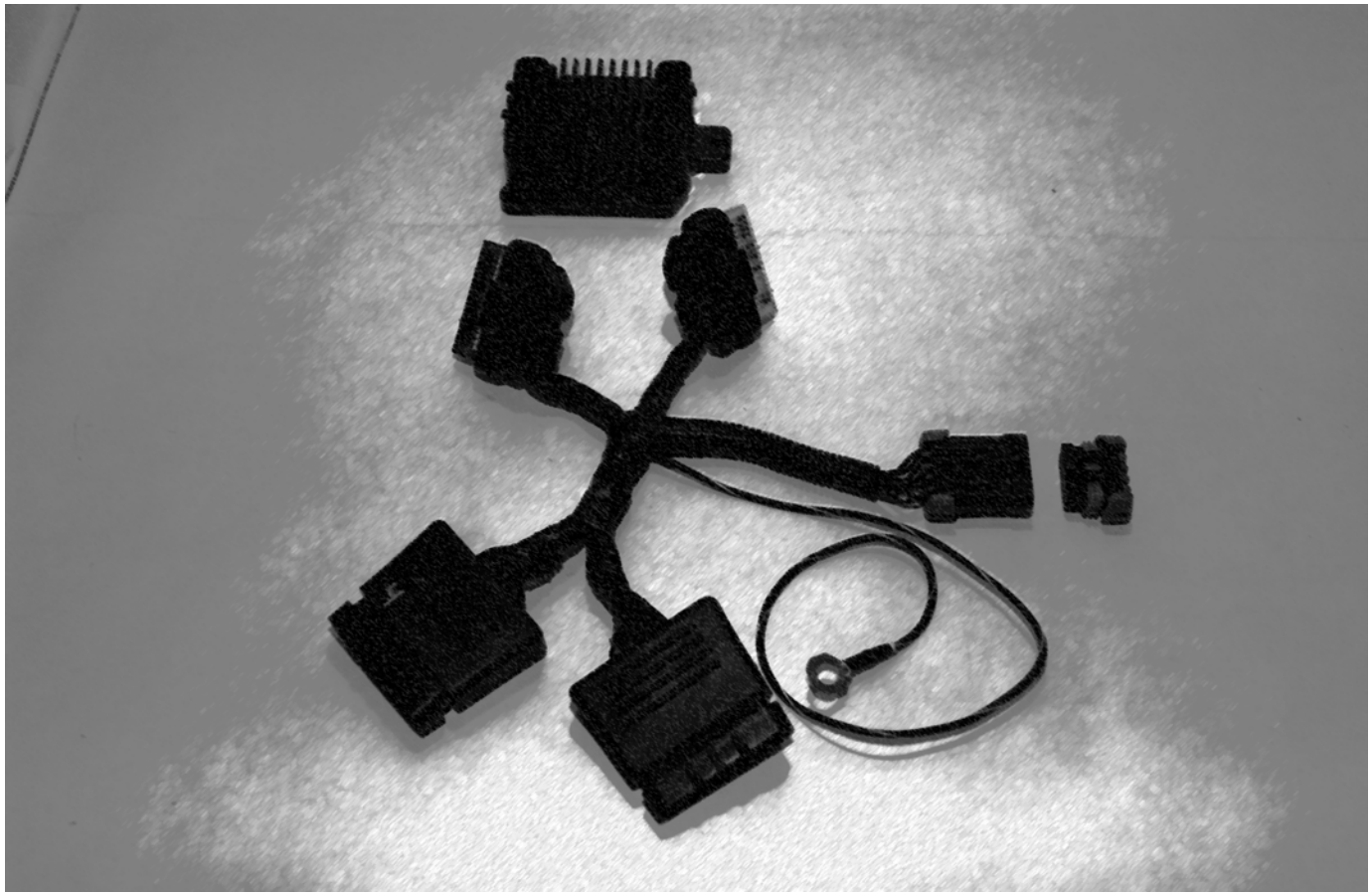
MEFI III to IV Conversion Kits

- **Kit Components**
  - MEFI IV ECM
  - Cross-Over harness
  - Secondary harnesses
  - Coil driver with heat sink
  - Coil driver bracket
  - Hardware
  - Instruction sheet
- **Kit Models**
  - 350 MPI & MIE 350 MPI FWC
  - 6.2 MPI
  - 7.4 MPI & MIE 7.4 MPI FWC
  - 454 MPI & MIE 454 MPI FWC
  - 502/8.2 MPI & MIE 8.2 MPI FWC
  - 4.3 EFI
  - 5.0 EFI
  - 5.7 EFI
  - MEFI III remans to remain for Black Scorpion and some High Perf models

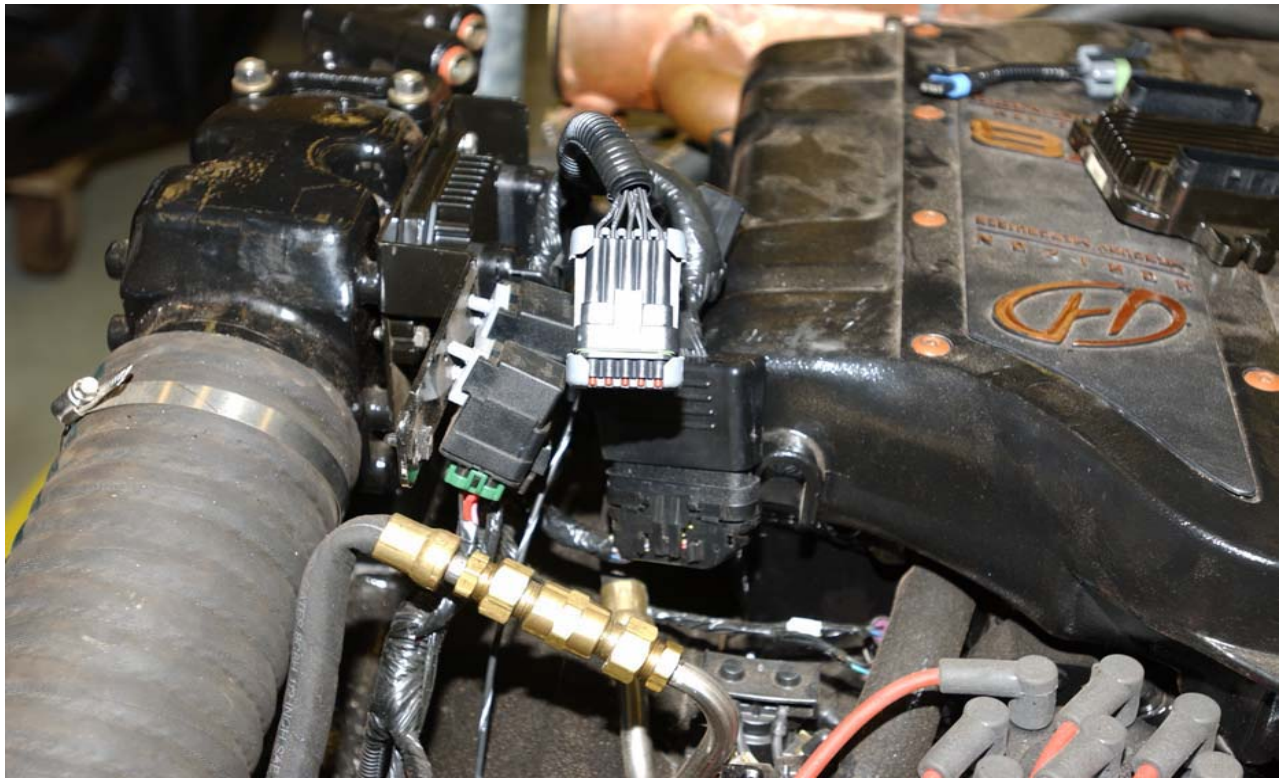
MEFI III to IV Conversion Kits

- **Installation Big Block**
  - Mount the MEFI IV ECM with existing hardware
  - Connect the J1 & J2 connections on the crossover harness
  - Connect ground wire to flywheel housing bolt that has no other ground connection on it

MEFI III to IV Conversion Kits
Big Block



MEFI III to IV Conversion Kits
Big Block

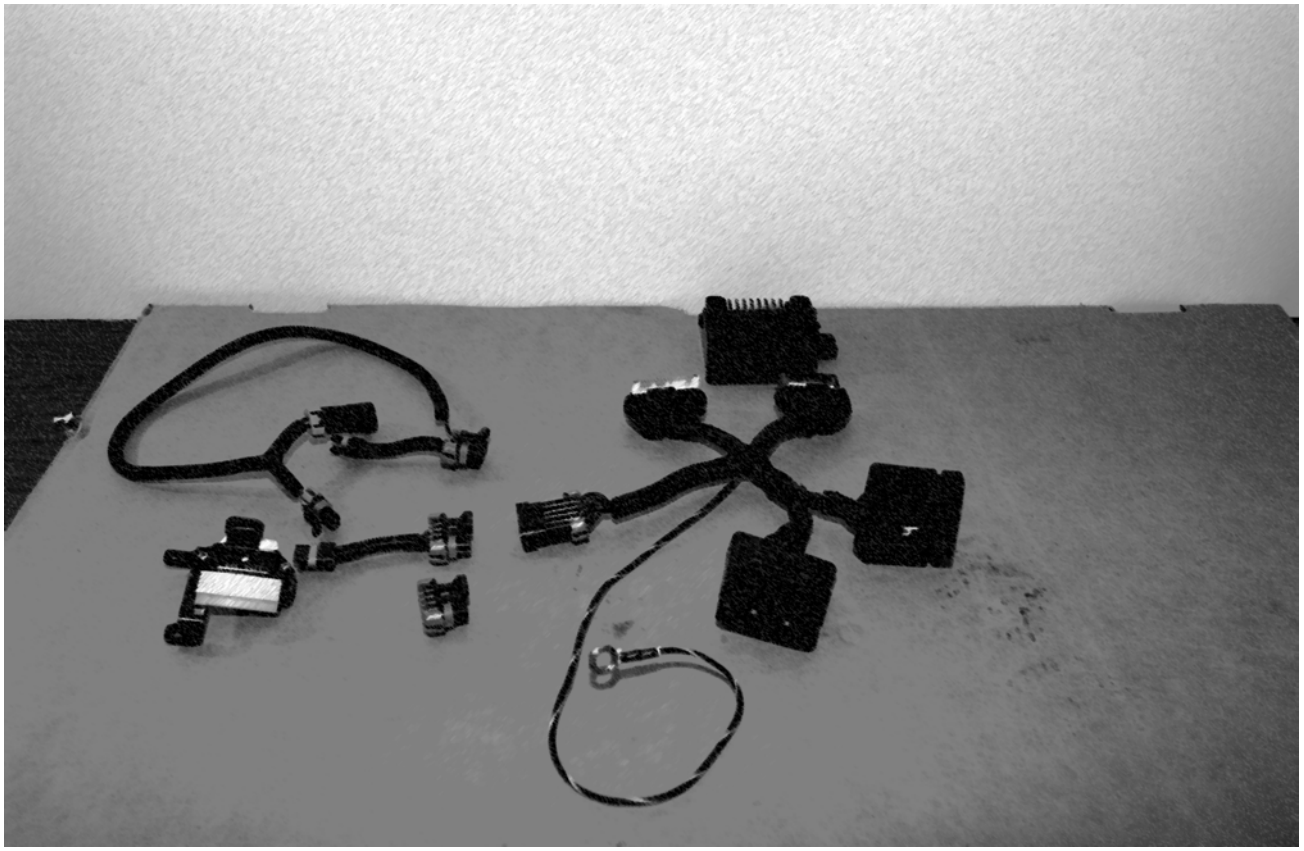


MEFI III to IV Conversion Kits
Big Block

MEFI III to IV Conversion Kits

- **Installation Small Block**
  - Mount the MEFI IV ECM with existing hardware
  - Connect the J1 & J2 connections on the crossover harness
  - Mount coil driver/bracket to relay bracket
    - Alpha requires spacer and screw provided
    - Bravo remove and retain rear MerCathode and rear relay bracket screw for mounting
  - MPI models connect coil driver harness to crossover harness then to coil driver
  - EFI models connect coil driver Y harness to crossover harness then to coil driver
    - Route Y harness to cool fuel box
    - Disconnect engine harness from fuel pump
    - Connect male connector of the Y harness to fuel pump
    - Connect female connector of the Y harness to the male engine harness connector

MEFI III to IV Small Block Kit Harnesses



MEFI III to IV Conversion Kits

- **Service Diagnostic Tools**
  - CDS version 3.14 or higher
    (Version 4.18 or higher for fuel pressure data stream correction)
  - MerCruiser Scan Tool version 4.0
    (Refer to bulletin number 2001-1)
  - THE DDT WILL NOT COMMUNICATE WITH THIS ECM (**N0 UPDATE CARTRIDGE WILL BE AVAILABLE**)

Gen III Cool Fuel System

System features:

- Single Integrated Module

  - Filter, pumps, pressure regulator and cooler, all in one unit

  - Fuel flows through filter before getting to lift pump

- More Reliable

  - Fewer components

  - Fewer fuel paths

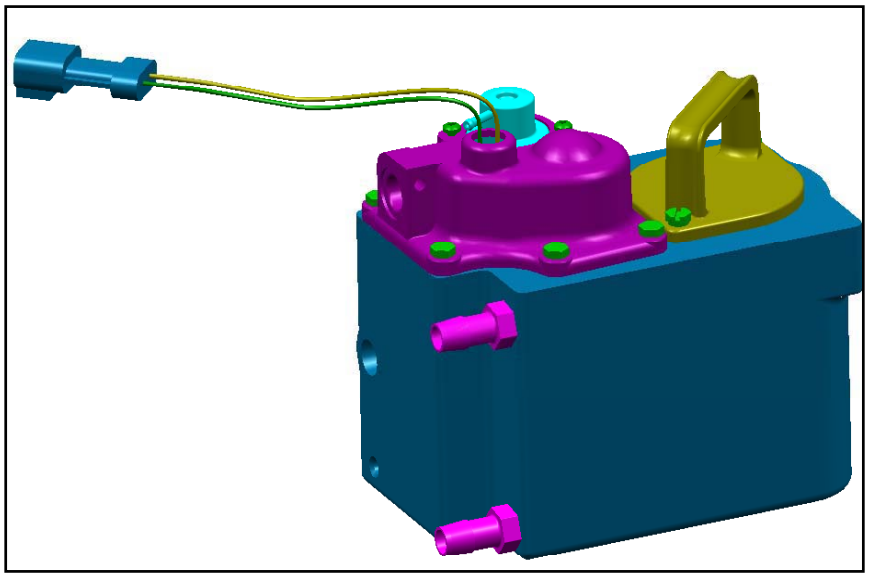
- Better Accessibility

- “Production-Friendly”

  - Eliminates installation of separate pre-filter at OEM

- Re-usable, consumer serviceable filter element

  - Pull element, dump water, re-install, continue voyage



This system will be standard on:

- Small-Block MPI V8 Bravo
- Small-Block MPI MIE
- Big-Block MPI Sterndrive
- Big-Block MPI MIE

It will not be available on:

- V6 Sterndrive
- Small-Block Ski
- Small-Block Alpha

System Overview

- Water Separating Filter Element
- 2 pumps – Lift & Pressure
  - Lift pump - Gerotor
  - Pressure pump – Turbine
- Fuel Pressure Regulator
  - New 288 kpa (~42 psi) regulator
  - O-rings seal between OD on regulator and ID in cover, rather than a face seal and return hose
  - Regulator dumps excess fuel to inlet side of pressure pump
  - Fuel pressure vs. flow characteristics differ slightly from Gen II, requires minor calibration changes
- Internal Low Pressure Relief Valve
  - Limits pressure across lift pump to 10 psi +/- 5 psi
  - Dumps fuel to inlet side of filter

System Module Features:

- Dual Pump Configuration

  - Improved Vapor Lock resistance compared to engines equipped with current boost pumps

- Corrosion Protection

  - Strontium-coated Internal water passage (same as outboards)

  - External housing e-coated

- Engine Installation

  - Low profile water connection, disconnect as required during engine installation

  - 3/8 NPTF thread inlet fuel connection

- Service Access

  - Modules located above front engine mount brackets in all applications

- Water Jacketed

  - Parallel water flow through module permits smaller module

- Pumps immersed in fuel and draw from bottom of cavity

  - Vapor rises to top of cavity, pumps always draw liquid

  - Reduced pump noise – not audible over engine at idle

- No external lines between filter, boost pump, pressure pump, and regulator

  - Eliminates 20 external fuel connectors

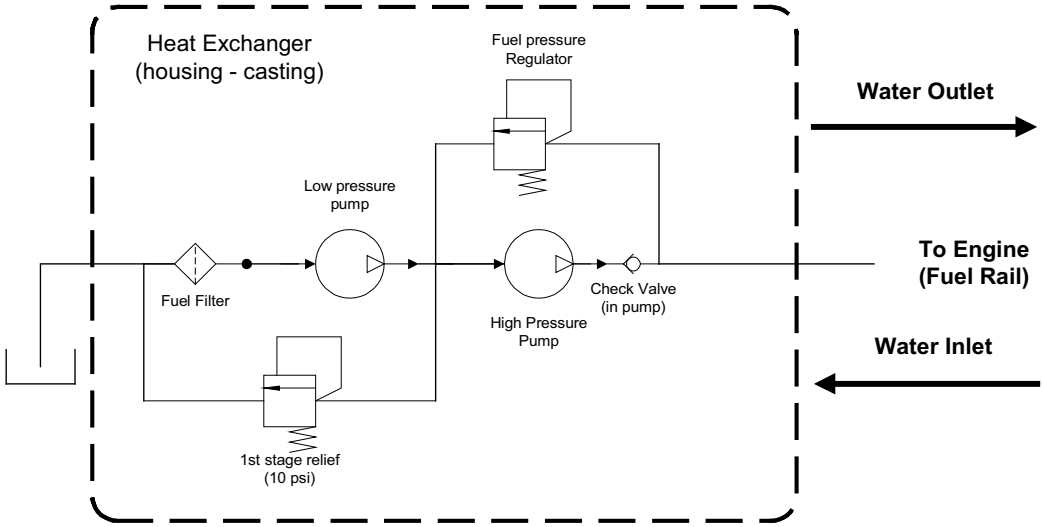
- 5 seals, not counting inlet and outlet

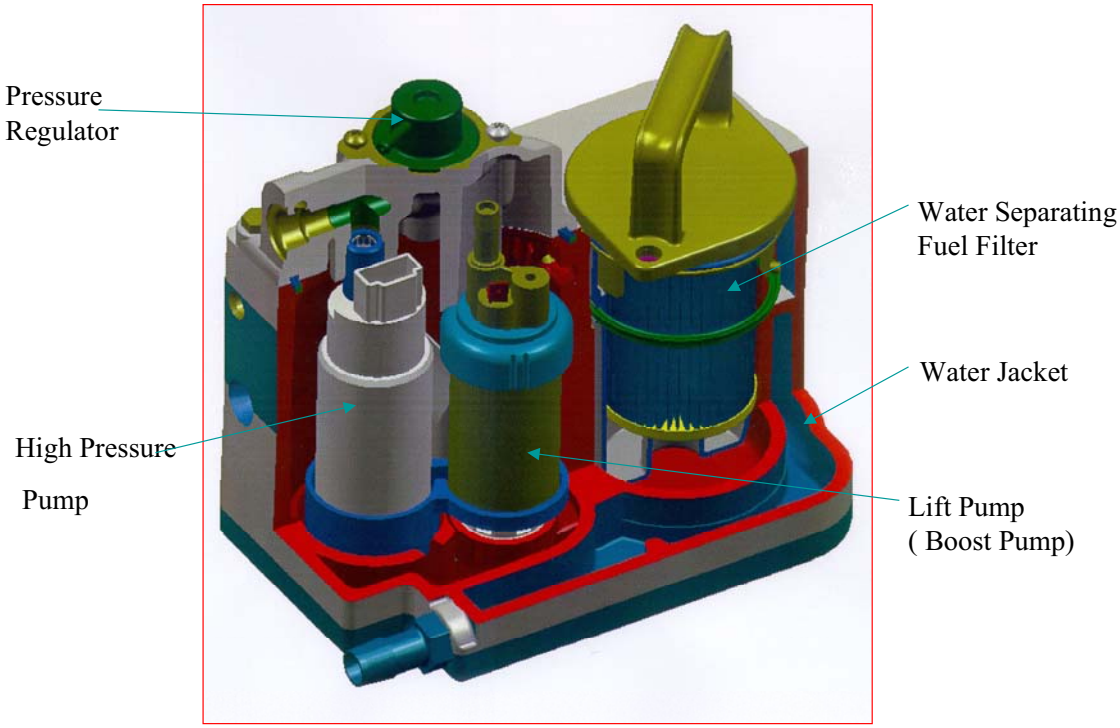
  - Filter cap – Modified SAE o-ring seal
  - Module Cover – Controlled-Crush quad ring
  - Pressure Regulator – Diametric o-ring
  - Pressure Relief Valve – Diametric o-ring
  - Harness – Fuel-tight pass-through fitting

- Self-Draining

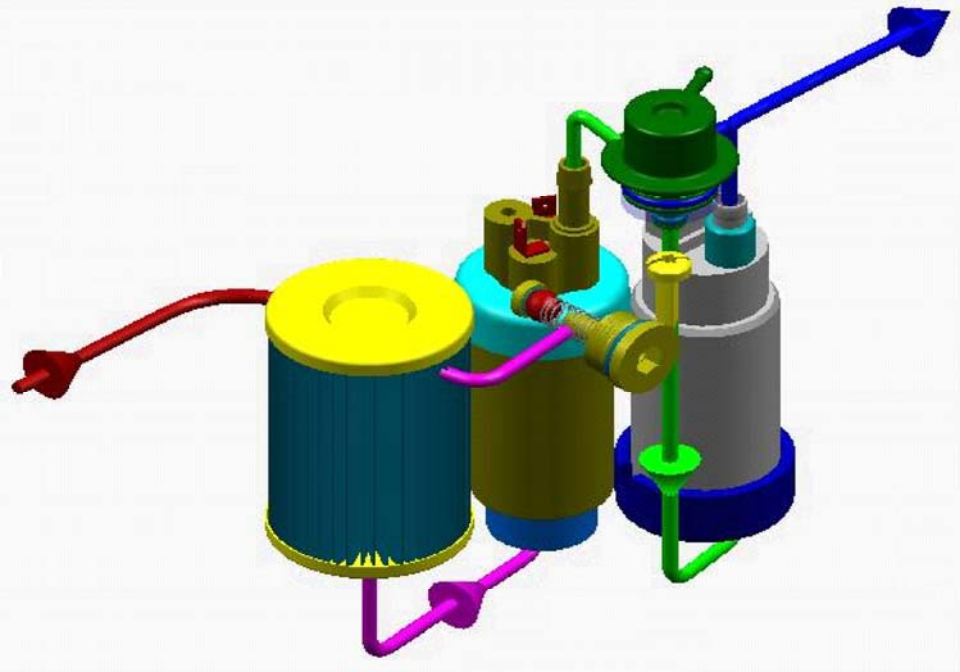
  - Drains when seawater pump outlet is drained

System Overview:

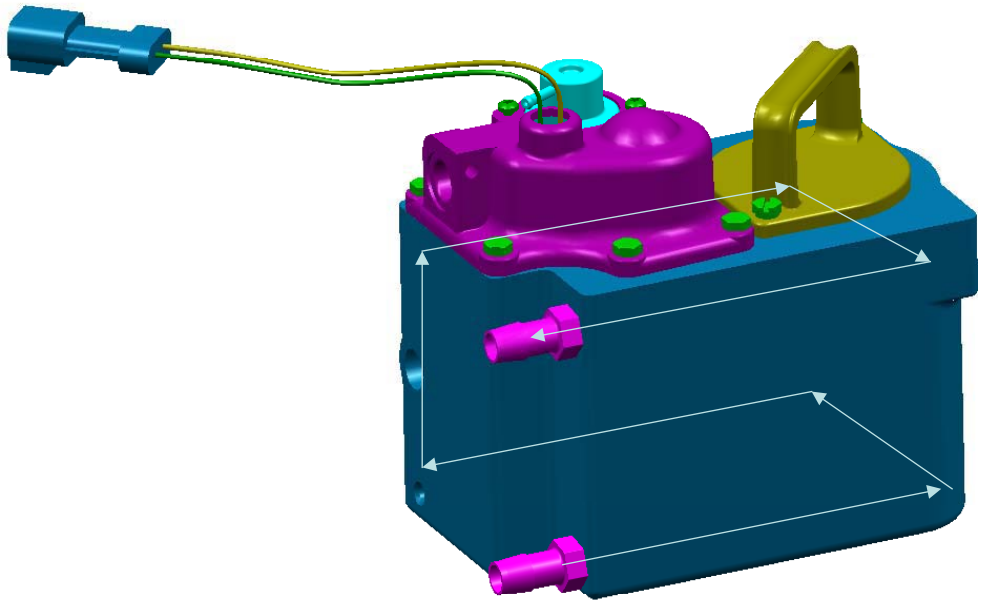




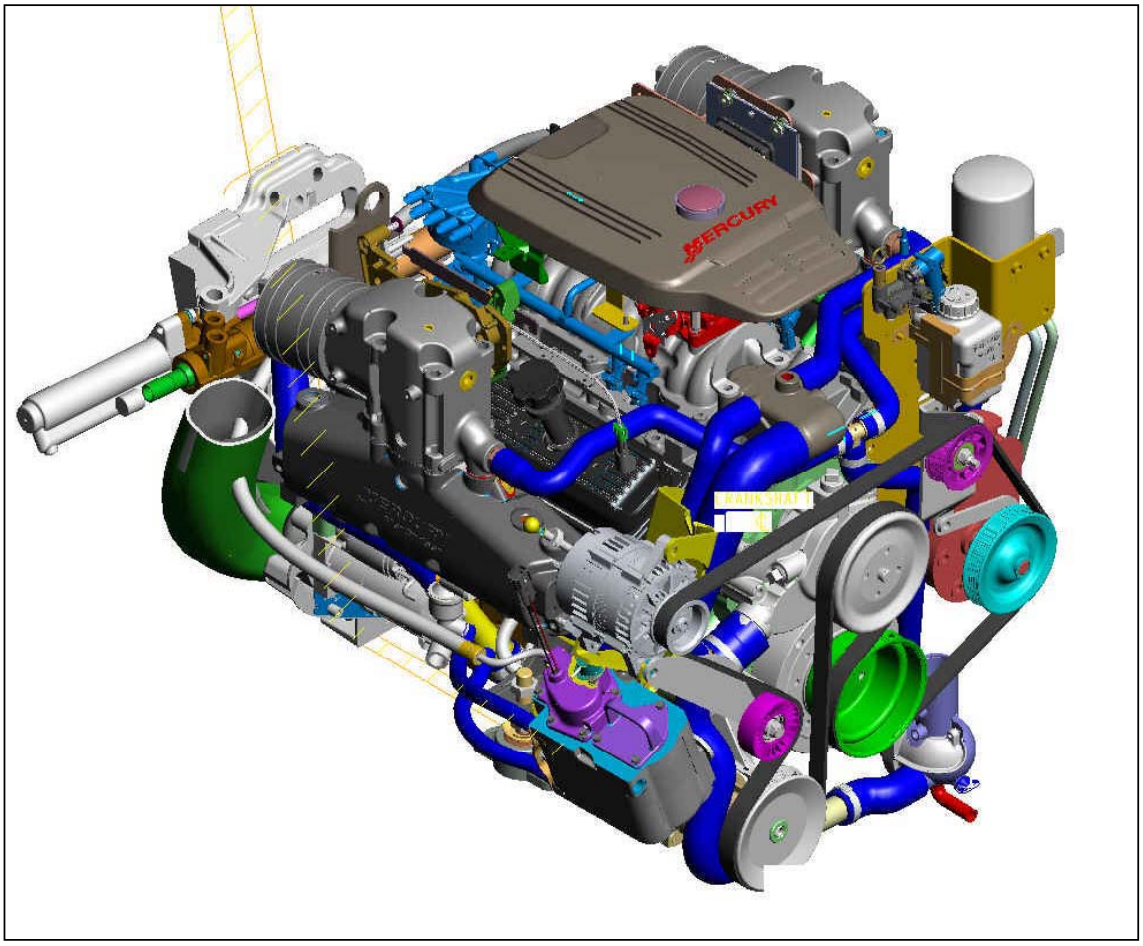
Fuel Flow Through the System

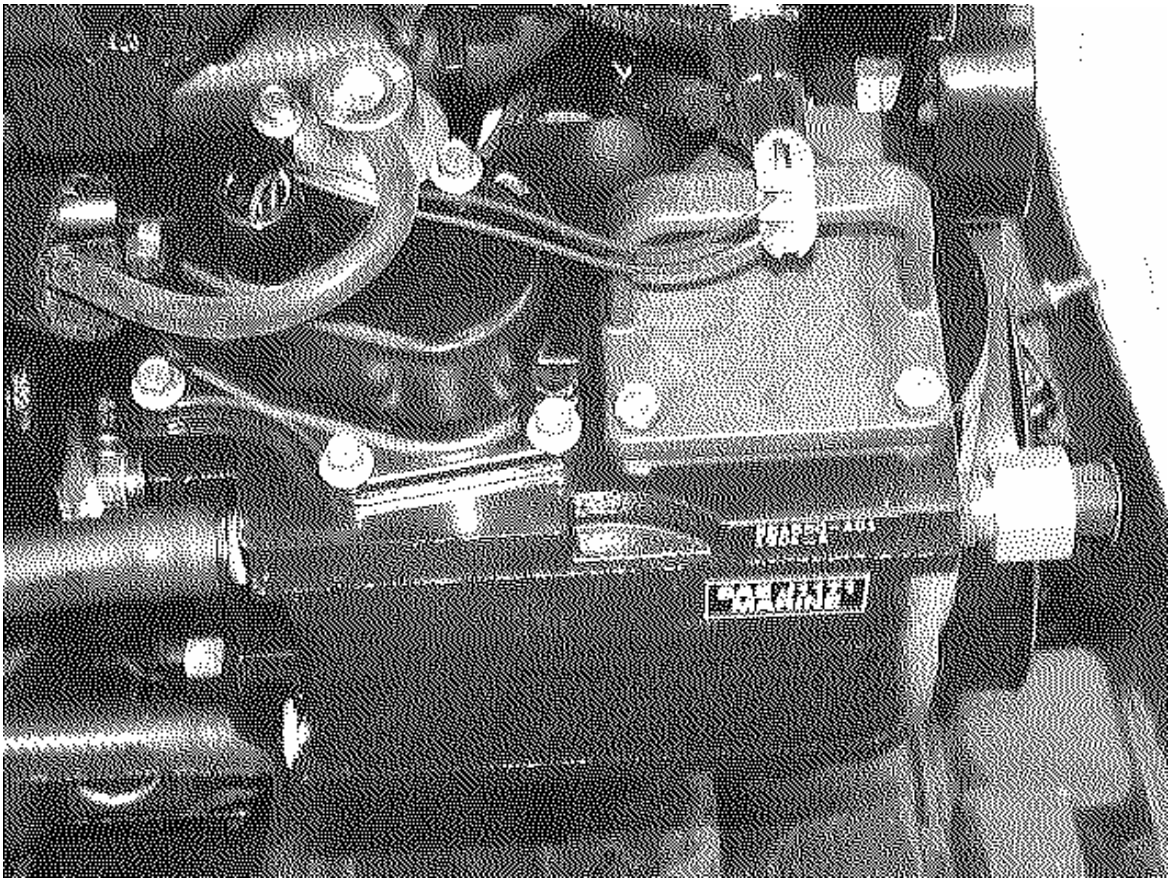


"2-Story" Water Flow Path



Cool Fuel III System - Mounted on Small-Block Engine





Gen III Cool Fuel Module

NOTE: This is a preliminary copy and it is subject to change.

Gen III Cool Fuel Module Diagnostics

Models Affected

Application	Model	Serial Number
MCM	496 Mag	0W060000 and above
All Bravo	5.0L MPI	0W060000 and above
All Bravo	350 Mag MPI	0W060000 and above
All Bravo	6.2L MPI	0W060000 and above
MIE	8.1L (all)	0W090000 and above
MIE	350 Mag MPI	0W090000 and above
MIE	6.2L MPI	0W090000 and above

Situation

A new generation of the MerCruiser fuel cooling system has been developed and released into production. The Generation III Cool Fuel system incorporates many design elements. The following information is provided for maintenance and troubleshooting of the Generation III Cool Fuel Module. Upon completion of these tests, if problem exists, replace the complete Cool Fuel Module assembly.

Changing Water Separating Fuel Filter Element

⚠ WARNING

Avoid Fire or Explosion: The fuel injection system is pressurized during operation. Use care when removing the water separating fuel filter. Fuel could spray on the hot engine causing fire or explosion. Allow the engine to cool down before attempting to remove the water separating fuel filter in the following procedure.

⚠ WARNING

Be careful when changing the water separating fuel filter. Gasoline is extremely flammable and highly explosive under certain conditions. Ensure the ignition key is "OFF". Do not smoke or allow spark or open flame in the area when changing the fuel filter. Wipe up any spilled fuel immediately.

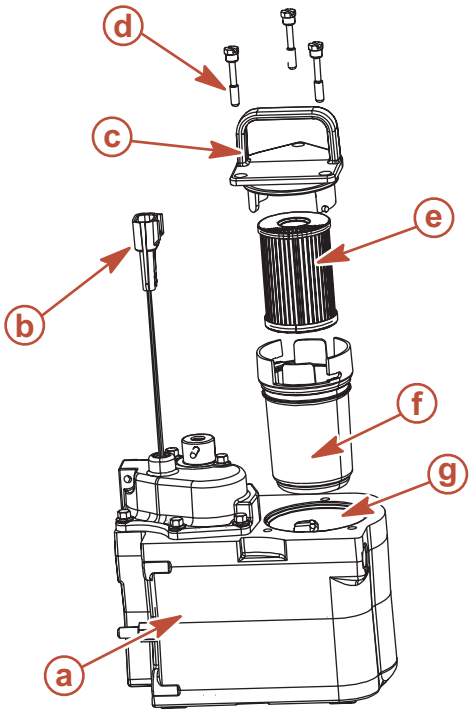
⚠ WARNING

Ensure that no fuel leaks exist before closing the engine hatch.

1. Allow the engine to cool down.

NOTE: *Mercury MerCruiser recommends that the engine be shut off for 12 hours prior to filter removal.*

2. Disconnect the Cool Fuel Module harness from the engine wiring harness.
3. Turn the key switch to the start position and allow the starter to operate for 5 seconds to relieve fuel system pressure.
4. Turn key switch to off position.
5. Loosen each filter assembly retaining screw until the screw is disengaged from the Cool Fuel Module. Do not remove the filter assembly retaining screws from the filter cap.



5658

a - Cool Fuel Module
b - Cool Fuel Module harness
c - Filter cap and O-ring
d - Filter assembly retaining screw
e - Fuel filter element
f - Filter cap
g - Cool Fuel Module filter reservoir

6. Unseat filter assembly by grasping filter assembly handle and pulling upward. Do not remove the filter assembly from the Cool Fuel Module at this time.
7. Allow any fuel that may be in the filter assembly to drain out through the bottom of the filter assembly and into the Cool Fuel Module filter reservoir.
8. Remove the filter cup from the filter cap by grasping the filter cap and rotating it in a clockwise direction while holding the filter cup stationary.
9. Remove the used water separating fuel filter element from the filter cup, place it in a clean, approved container.

10. Dispose of any water or debris that may be in the filter cup.
11. Install a new water separating fuel filter element into the filter cup. Push the element into the cup until completely seated. Inspect O-ring in cap and replace if necessary.
12. Attach the filter cap to the filter cup by grasping the filter cap and rotating it in a counter clockwise direction while holding the filter cup stationary, until filter cap locks securely into place.
13. Install the fuel filter assembly slowly into the Cool Fuel Module to prevent spilling fuel, and align the screws retained in the filter cap with the screw holes in the Cool Fuel Module. Tighten the filter assembly retaining screws until hand tight.
14. Torque each filter assembly retaining screw.

Description	Nm	lb. in.	lb. ft.
Filter assembly retaining screw	4.5	40	

15. Reconnect the Cool Fuel Module harness to the engine wiring harness.
16. Supply cooling water to the engine.
17. Properly ventilate engine compartment.

⚠ WARNING

Avoid serious injury or death due to FIRE or EXPLOSION. Ensure that engine compartment is well ventilated and that no gasoline vapors are present to prevent the possibility of a FIRE or EXPLOSION.

⚠ WARNING

Ensure that no fuel leaks exist before closing the engine hatch.

18. Start the engine. Check for gasoline leaks around the fuel filter assembly. If leaks exist, stop the engine immediately. Recheck filter installation, clean spilled fuel and properly ventilate engine compartment. Correct the leak.

Electrical

1. Disconnect electrical connector at Cool Fuel Module.
2. Connect Digital Volt / Ohm Meter (DVOM) to engine side of electrical connector.
3. Turn ignition switch to run position.
4. Verify that there is 12 volt battery (+) power going to the Cool Fuel Module.

NOTE: *The fuel pump relay will only remain active for 2-3 seconds while the key is in the RUN position.*

Checking Fuel Pressure

1. Connect fuel pressure gauge to shrader valve on fuel rail.
2. Cycle key switch 2-3 times (OFF to RUN position) at 3 second intervals to reach maximum pressure.
3. Verify that the pressure is within specification.

4. If pressure is exceeds 44 psi:
    a. Replace Cool Fuel Module.
5. If pressure is equal to or less than 40 psi:
    a. Use a tee fitting and connect a vacuum gauge to the fuel inlet side of the Cool Fuel Module. Do not remove fuel inlet fitting adapter.
    b. Cycle key switch 2-3 times (OFF to RUN position) at 3 second intervals to reach maximum pressure.
    c. Verify that the vacuum from the fuel source is within specification. If vacuum is exceeds 2" Hg, excessive fuel restriction exists. Correct fuel restriction before proceeding.
    d. With vessel secured to the dock and engine running in neutral, restrict fuel supply and verify that the Cool Fuel Module has the ability to cause a vacuum reading of 11" Hg or greater. If vacuum reading is less than 11" Hg with fuel supply restricted, replace Cool Fuel Module.

In-Water Test

1. With vacuum gauge and fuel pressure gauges in place, run the boat underway throughout the RPM range and record the pressure and vacuum readings.
2. If fuel supply vacuum reading is greater than 2" Hg, find and correct fuel supply restriction.
3. If fuel supply vacuum is within specification and fuel pressure is less than 40 psi, replace Cool Fuel Module.

IMPORTANT: It will be necessary to sea-trial the boat following repairs to be sure that the pressure and fuel system vacuum remain within specification throughout the RPM range.

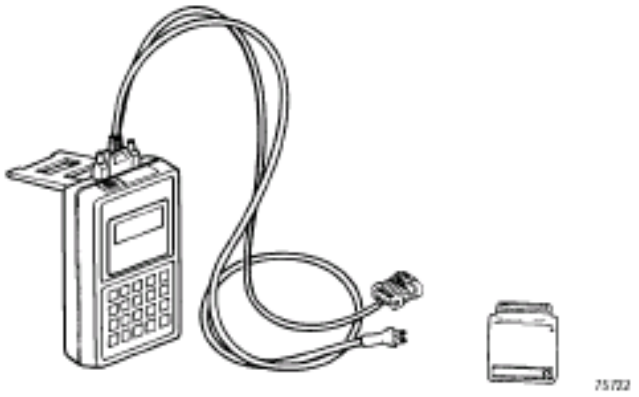
Digital Diagnostic Terminal (DDT) Cartridge - 1.31 Version

WHAT'S NEW FOR CARTRIDGE VERSION 1.31 – SMARTCRAFT PCM'S/ECM'S

- Guardian Active Due To: – Fault Status 2004 MY and up
- Demand % – Data Monitor (DTS production models only)
- 'Master Print All' Function – History
- Set Maximum Trim Limit Position – Special Functions
- Set Maximum Trailer Limit Position – Special Functions
- Start/Stop Engine (DTS models only) – Output Load Test
- Shift Engine (DTS models only) – Output Load Test
- TDC Offset (OB) – Special Functions
- Glossary of terms updated
- FAQ updated
- Tach Link Config – Special Functions
- All prior PCM/ECM 555 models supported

Cartridge should be available in 2004.

P/N 91-880118A04



MERCURY

Computer Diagnostic System

Mercury Marine has partnered with SPX Corporation to develop a PC-based diagnostic system called “Computer Diagnostic System” or “CDS”. This system is designed to aid the dealership technician by reducing the diagnostic times required to identify the root cause of electrical and electronic fuel controlled system problems. The software consists of a user friendly menu driven interface, engine data screens, step-by-step pinpoint guided diagnostics for certain models, internet connectivity for timely software updates, and integrated service manuals.

The following pages contain information about this system.

CDS Section Table of Contents

Computer Diagnostic System Announcement Letter

CDS / DDT Comparison Matrix

CDS FAQ's

Computer Diagnostic System Components

Computer Requirements for running the Mercury Computer Diagnostic System (CDS) software and hardware

Computer Diagnostic System – Service Bulletin 2004-04

MERCURY
Computer Diagnostic System

Dear Mercury Trade Partner

In recent years, Mercury Marine has made significant enhancements to our outboard and MerCruiser engines. These changes were made to improve reliability, performance and increase customer satisfaction with our products. These same changes also made our engines more complex and sometimes more difficult to diagnose problems. Mercury Marine has expended considerable effort in developing a system that will simplify troubleshooting problems with these more complex engines.

Mercury Marine has partnered with SPX Corporation to develop a PC-based diagnostic system called “Computer Diagnostic System” or “CDS”. This system is designed to aid the dealership technician by reducing the diagnostic times required to identify the root cause of electrical and electronic fuel controlled system problems. The software consists of a user friendly menu driven interface, engine data screens, step-by-step pinpoint guided diagnostics for certain models, internet connectivity for timely software updates, and integrated service manuals.

The basic Computer Diagnostic System is offered in three different configurations. The first will consist of diagnostic software, SmartComms Interface Box, storage case, Dell D500 laptop and Quick Setup Guide. The second configuration includes all of the items listed above and includes a “Rugged” Panasonic CF-18 laptop computer in place of the Dell D500 laptop. The third configuration available is designed for our partners who have recently purchased a computer and do not wish to purchase another. We offer the diagnostic software and SmartComms Interface Box to those who have a computer that meets the minimum system requirements.

Optional kit accessories available include: an Electrical Harness Break-Out Box, Harness Pin Probes, 12 Volt DC Adapters, and the DMT 2004 VOM Meter with communications interface. Additionally Mercury Precision Parts is developing an Electronic Dual Pressure Tester with communications interface. These communications interfaces will reduce required technician key strokes, remove entry errors and decrease troubleshooting times when using the pinpoint guided diagnostics.

Please read the accompanying materials for additional details.

Sincerely,

Mercury Marine

MERCURY
#1 On The Water

Mercury Marine®
Computer Diagnostic System/DDT Comparison Matrix

	CDS	DDT
View and Clear – Current and Historic Codes		
4 lines displayed		•
10 lines displayed	•	
Read Data Stream Items		
MerCruiser		
555 PCM / ECM	•	•
GM MEFI	•	•
Thunderbolt V	*	•
Outboard		
555 PCM / ECM	•	•
2000 and prior DFI ECM	*	•
2.5L with 824003 ECU	*	•
3.0L Fuel ECM	*	•
3.0L Ignition ECM	*	•
2.5L Hi-Performance ECM (1998 and later)	*	•
FourStroke Carbureted ECM	*	•
225 / 115 EFI FourStroke	*	
Future Product (CAN and DTS Control Module)	*	
Display Data Stream		
4 items		•
14 items	•	
Data Display Options		
Single item expanded mode with min. / max.	•	•
4 item meters with min. / max.	•	
4 item graphs	•	
Active Tests	•	•
Updatable Diagnostic Information		
Requires new cartridge		•
Software updates are downloaded via internet or DVD	•	
Print Diagnostic Data		
Special printer, difficult to use and interpret		•
Standard printer, easy to use and understand	•	

	CDS	DDT
Record Data		
Short periods of time	•	•
Large periods of time	•	
Multiple Files	•	•
Playback Recorded Files		
Manual advance single frame at a time	•	•
Automatic advance	•	
Ability to use different display methods	•	
Trouble code indicator during playback	•	
Electronic File Transfer to Mercury Technical Service		
Static – both engine data and fault buffers	•	
Dynamic recorded files – allows review of running engine over periods of time	•	
Supports Multiple Languages	*	
Electronic Service Manuals		
MerCruiser	•	
Mercury / Mariner Outboards	•	
Racing	•	
M2 Jet Drives	•	
Pinpoint Guided Diagnostics		
Step-by-step diagnostic trees	•	
Circuit specific colored wiring diagrams	•	
Color photographs show component locations	•	
Stores electronic file of diagnostic sequence	•	
Digital Volt Ohm Interface	•	
Water Test Record Module		
Automatic recording started by fault code	•	
Manual recording with lanyard switch	•	

* Future enhancements to CDS

MERCURY #1 On The Water

SPX SERVICE SOLUTIONS
1-800-345-2233

Promotion # MM03-572

Mercury Marine®

Computer Diagnostic System (CDS) – FAQ

The Computer Diagnostic System (CDS) is Mercury Marine's next generation diagnostic tool. The tool replaces the Quicksilver (DDT) Scan Tool currently used in Mercury Marine dealerships. Here is a list of frequently asked questions regarding CDS.

1. **Why is the Quicksilver (DDT) Scan Tool being replaced?**
   Two main reasons, first; the DDT is being phased out of production by the supplier. There are limited amounts of the DDT available at this time. Second: The processor inside the DDT is older technology and limited in its communications speed. With the migration to the Control Area Network (CAN) on the newer products, the DDT can only read filtered communications from the ECM, not real-time communications on the CAN bus.

2. **Will I still be able to use my DDT Scan Tool?**
   Yes. You will still be able to use your DDT Scan Tool on older products and current production engines. Use on future products will be limited. Currently we are planning one additional cartridge release for the DDT.

3. **Does the CDS contain legacy information?**
   Yes. At the start of production the CDS system will read all 555 ECM & PCM processors, along with the MerCruiser MEFI engines from 1994. As development continues, we expect to include the older digital outboard engines.

4. **What are the major components of the CDS system?**
   The CDS system consists of a laptop computer using the Windows 2000 operating system and a SmartComms interface box. The interface box allows the computer to communicate with the ECM on the engine. Other components are available and explained in the advertising literature.

5. **Will I need new cables to connect the CDS system to the engine?**
   The current DDT cables connect directly onto the SmartComms interface box and work with the CDS system. Of course, newer products may require the purchase of additional cables. Every attempt is being made to use the existing cables.

6. **Where can I purchase a CDS system?**
   Contact SPX at the address given in the advertising literature. You will need your dealer information. Under contract SPX cannot sell the CDS system to anyone unless approved by Mercury Marine.

7. **What is the warranty on the CDS system?**
   The standard warranty is for three years? If you wish, extended warranty coverage can be purchased at an additional cost. Refer to the advertising literature for additional information.

8. **Can I load other software onto the CDS laptop?**
   Yes, the system is not locked down. Please note that this is done at your own risk. We support the standard configuration and setup. The recovery disk supplied with the CDS system will return the unit back to the original setup, any additional data will be lost.

9. **What additional functionality does the CDS offer over the DDT?**
   Refer to the comparison matrix for detail between the two systems.

10. **Who do I call for technical assistance?**
    Contact SPX at 1-800-345-2233 between 8:00-5:00 E.S.T.

11. **What is the difference between the Basic and Deluxe kits?**
    The Basic kits allow the technician to perform fundamental diagnostic tests. The Deluxe kits contain hardware that will maximize the CDS software. The technician will be able to perform Water tests, PinPoint diagnostics, multimeter functions and probe wiring harnesses.

12. **How will the CDS software be updated?**
    Based on the file size, the CDS software will be updated with a new DVD or FTP session.

13. **Can I purchase the CDS software and load it on my own PC?**
    Yes, CDS can be loaded onto any PC but the software has only been validated and approved to work on either the Panasonic Toughbook CF18 or Dell D500 laptops. Loading CDS software on other hardware may create driver configurations and other conflicts preventing CDS and possibly other applications from working properly. Please contact 1-800-345-2233 for additional information.

MERCURY
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SPX SERVICE SOLUTIONS
1-800-345-2233

Promotion # MM03-572

CDS - Computer Diagnostic System - Components

Dell Latitude Laptop Computer

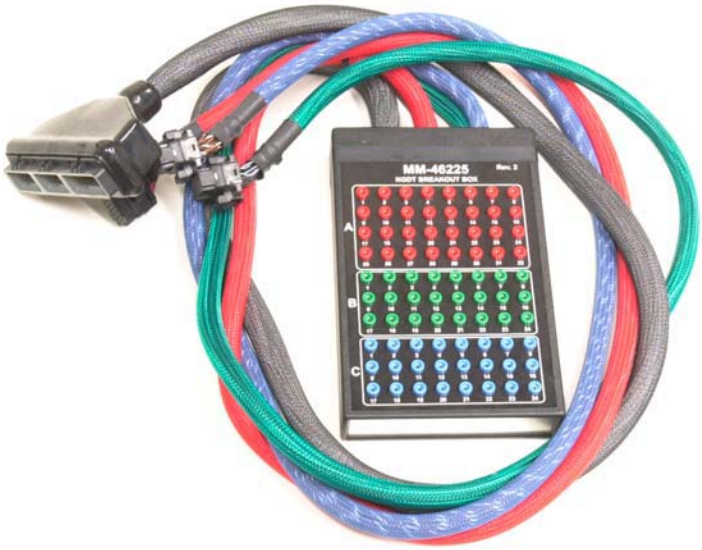
Panasonic Toughbook Laptop Computer

TOUGHBOOK 18
RUGGED, LIGHTWEIGHT,
WIRELESS AND CONVERTIBLE
Mobile Star Award
• Notebook PC Convertible to Tablet PC Design
• Full Magnesium Alloy Case
• 4.4 lbs. Lightweight Design
• Integrated Wireless WAN, LAN and GPS
• Intel® Centrino™ Mobile Technology
- Intel® Pentium® M Processor 900 MHz
- Intel® 855GM Graphic Controller
- Intel® PRO/Wireless Network Connection 802.11b
centrino
MOBILE TECHNOLOGY
WIRELESS READY

SmartComms Module

Pin Probe Kit & Loaded Volts Lead

Break-Out Box



New Digital Meter With Serial Connection for Conecting to Laptop

Various Kit Configurations Available

Computer Requirements for running the Mercury Computer Diagnostic System (CDS) software and hardware:

- 900 MHz Pentium Processor
- USB port
- Windows 2000 (or XP backed down to 2000)
- 56K Modem
- PCMCIA slot
- 256 MB Ram
- DVD Drive
- 10 GB Hard Drive
- Serial Port

MERCURY MerCruiser

Service Bulletin

☐ Warranty Information ☑ Service Information Bulletin No. 2004-04
☐ Parts Information OEM No. 2004-02

Circulate to: ☐ Sales Manager ☐ Accounting ☑ Service Manager ☑ Technician ☑ Parts Manager

Computer Diagnostic System

Models Affected

MerCruiser*

Models Covered	Serial Number Or Year
MCM/MIE MEFI, EFI (TBI) and MPI Gasoline Models	All Models
MCM/MIE PCM/ECM 555 or PCM 03 Gasoline Models	All Models

Mercury/Mariner Outboards*

Models Covered	Serial Number Or Year
OptiMax with PCM 555 or PCM 03	2001-1/2 and up
EFI with PCM 555 or PCM 03	2002
30/40/50/60 EFI FourStroke with ECM 555	2002 and up

Jet Drives*

Models Covered	Serial Number Or Year
200 DFI	All Models
240 EFI with PCM 555	All Models

Mercury Racing*

Models Covered	Serial Number Or Year
Outboards with PCM 555 or PCM 03	All Models
MerCruiser Models with MEFI Fuel Injection	All Models
MerCruiser Models with PCM 555 or PCM 03	All Models

* Future software releases will include other models with digital processors.

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Situation

Mercury Marine has partnered with SPX Corporation to develop a PC-based system designed to aid the dealership technician by reducing the diagnostic times required to identify the root cause of electrical and electronic fuel controlled system problems. The software consists of a user friendly menu driven interface, engine data screens, step-by-step pinpoint guided diagnostics for certain models, internet connectivity for timely software updates, and integrated service manuals.

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Version in English is available; other languages will be supported in future releases.

The CDS system will use the same diagnostic harness assemblies as the DDT. Diagnostic harness assemblies are not included in the kit from SPX and must be ordered from Mercury Precision Parts. The diagnostic harness assemblies are listed at the end of the bulletin.

Minimum System Requirements

900 MHz Pentium Processor
USB port
Windows 2000
56K Modem
Serial Port
PCMIA slot
256MB Ram
DVD Drive
10 GB Hard Drive

Ordering Information

To get additional information, pricing or to order the Computer Diagnostic system contact:
SPX Corporation
28635 Mound Rd.
Warren, MI 48092
or call:

USA - 1-800-345-2233
Canada - 800-345-2233
Europe - 49 6182 959 149
Australia - (03) 9544-6222

Adapter Cable Harnesses

Mercury/Mariner Outboard and Jet Drive Adapter Harnesses

Harnesses are purchased from Mercury Precision Parts.

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NOTE: All harnesses are not used with current software revision level. Future software releases will use additional harnesses.

Description	Part Number
1994 3.0L Carb Engines	84-822560A 1
1994-1/2 and up 2.5L EFI (with 824003 ECM only) 1994-1/2 Pro Max/Super Max/Super Magnum 1997 and up DFI/OptiMax Outboards	84-822560A 5
1995 - 2001 3.0L EFI and Carb Outboards (Use with 84-822560A 7)	84-822560A 6
1995 - 2001 3.0L EFI and Carb Outboards (Use with 84-822560A 6)	84-822560A 7
All Hi-Performance 2.0L/2.5L EFI Outboards (with 11350A ECM only) (Use with 84-822560A 7)	84-822560A 8
25-40 hp 4-cycle Outboards. (Use with 84-822560A 7)	84-822560A10
Extension Harness, 2-pin 4.57 m (15 ft.) (Use with 84-822560A 5)	84-822560T11
2000 Digital OptiMax Outboards only. This T Harness allows the DDT to be connected under the dash at the 5-pin tachometer harness outlet.	84-875232T 1
For Verado 200-275 hp (adapts flat 4-pin connector to 2-pin 84-822560A5 harness).	84-822560T12
Verado 200-275 hp 4-Cycle Outboards (4-pin connectors, no additional harness required)	84-822560A13
225 EFI FourStroke. Not for use with the DDT.	84-822560A14
CAN 1 diagnostics cable. Connects into a junction box or male to male adapter cable for Command Module configuration. Not for use with the DDT.	84-892663
Male to male adapter cable. Allows connection between CAN 1 communications cable and Command Module harness in applications where a junction box is not used.	84-892452A01

Mercury/Mariner Outboard Injector Test Harnesses

Description	Part Number
1986 and up 2.4L/2.5L/3.0L EFI Outboards. (Use with 84-822560A 7) 1982 and up Hi-Performance 2.0L/2.4L/ 2.5L/3.4L EFI Outboards (Use with 84-830043A 2)	84-830043A 1
1982 and up Hi-Performance 2.0L/2.4L/2.5L/3.4L EFI Outboards (including Offshore models). (Use with 84-830043A 1)	84-830043A 2

MerCruiser Adapter Harnesses

Harnesses are purchased from Mercury Precision Parts.

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NOTE: *All harnesses are not used with current software revision level. Future software releases will use additional harnesses.*

Description	Part Number
For MEFI-1/-2/-3 ECM models	84-822560A 2
For PCM 555 models (adapts 4-pin MerCruiser connector to 2-pin Outboard harness)	84-822560T12 and 84-822560A 5
For PCM 555 models (4-pin connectors, no additional harness required)	84-822560A13
1997 and up V6 and V8 Carb Engines with Thunderbolt V Ignition. Allows RPM history stored in Ignition Module to be read. (Use with 84-822560A 7)	84-861540A 1
CAN 1 diagnostics cable. Connects into a junction box or male to male adapter cable for Command Module configuration. Not for use with the DDT.	84-892663
Male to male adapter cable. Allows connection between CAN 1 communications cable and Command Module harness in applications where a junction box is not used.	84-892452A01

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MERCURY MerCruiser

2

2004
Product Update

Section 2

Electrical Systems

Table of Contents

2005 SmartCraft DTS Updates

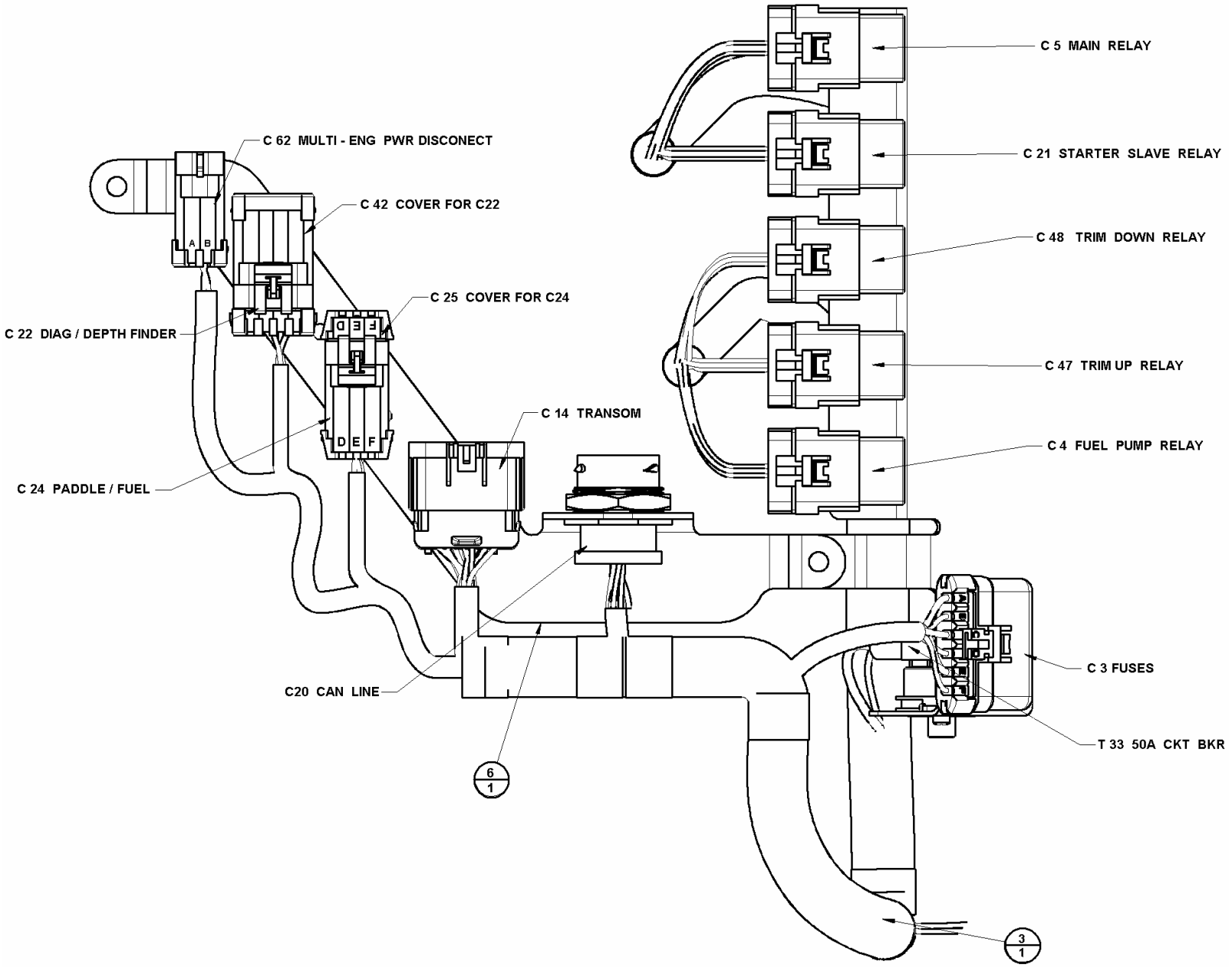
Service/Repair of Electrical Test Equipment

2005
496/8.1 DTS changes and over view of the new 5.0 DTS

Deutsch 14 Pin Electrical Connector

- **Project Definition**
  - Replacement of Mercury Molded 10 Pin Engine Electrical Connector on all engine platforms.
  - 1st Engine Platform Slated for SOP (dual connectors)
    - 496/8.1L Mechanical & DTS
  - Redesign Engine Harness – Aesthetics / Ease of Assembly
- **Benefits**
  - Does not require the use of a hose clamp
  - Quick connect / disconnect bayonet style coupling
  - Reduction of installation time
  - Significantly increased reliability
  - Designed specifically for the truck, bus and off-highway industry, the HDP 20 series is a heavy duty, environmentally-sealed, composite shell, multi-pin connector that is far superior to the molded 10 Pin cannon plug.
- **OEM Impact**
  - Dual (14 & 10 pin) connection implemented in **July 2004** on 496/8.1L DTS and Mechanical Engines
  - Other engines – TBD – ***need input from OEM***
  - Removal of molded 10 Pin from all engine platforms – TBD – ***need input from OEM***
  - SmartCraft Connections moved to top of engine
  - **35 Amp DC power (via 50 Amp breaker) from engine no longer available**. A high current accessory harness assembly fused at 40 Amps is available from Mercury. OEM can spec and build their own power supply harnesses.

DTS 496 / 8.1 New Harness Plug Locations



SmartCraft / DTS MY 2005

- **Project Definition**
  - SmartCraft DTS for MY '05 is an extension of the current DTS program, which is continuously evolving/improving via feedback from OEMs and customers
  - Adds six new engine platforms
  - Adds a new electronic shift control for inboards
  - System Link driver now a part of PCM/ECM
  - Incorporates new software features including multi-helm station control
  - New gauges available
  - Several other P&A components available

- **Benefits**
  - Improvements to the SmartCraft/DTS product line "across the board"
  - More options than ever available for the discerning customer
  - Custom helm display combinations easy to produce and market reliably

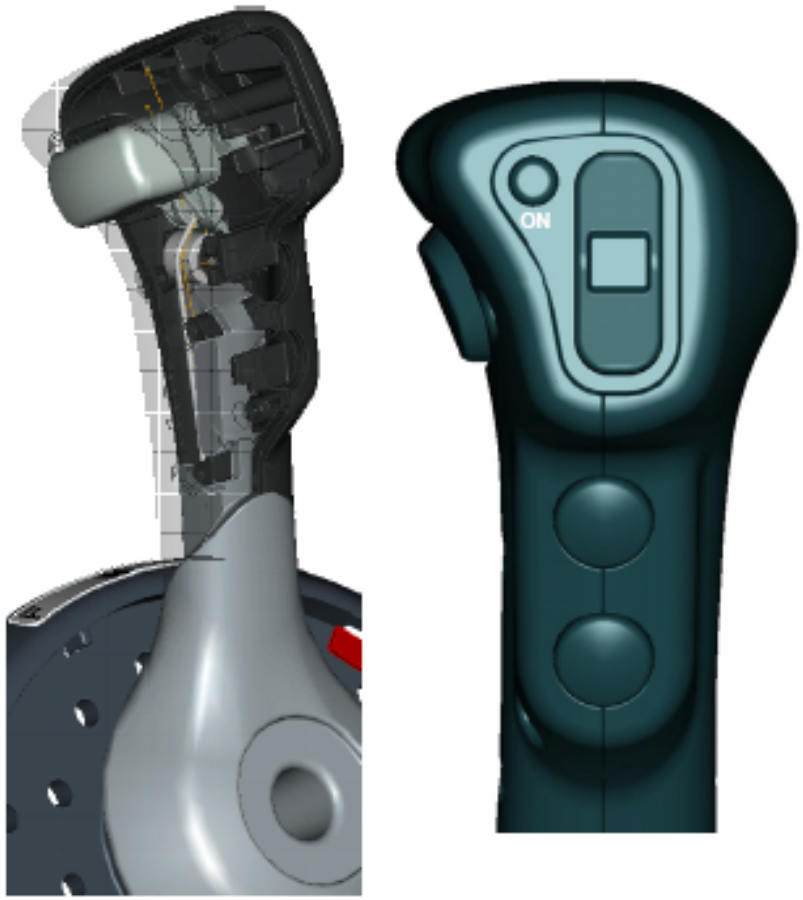
- **OEM Impact**
  - Must gain SmartCraft/DTS knowledge and become proficient via training and certification
  - DTS cuts overall installation time with "plug and play" components
  - Technology derived from the automotive industry makes boating safer, easier, more reliable, and thus more fun for the customer (and more non-boating background customers enter the marketplace)

Available For OEM	Applications	Offerings / Additional Features
07.15.04	8.1L Base MIE/MCM 8.1L HO MIE/MCM	– Tach Link – Foot Throttle ERC – SV5000 GUI Upgrades – Tach / Speed Upgrades – Multi-helm Station Control – Laptop Diagnostic Tool (CDS / SPX software) – 14pin Architecture – MIE Electric Shift – Panel Mount Lockout ERC with Throttle Only Mod – Binnacle Mount ERC with Throttle Only Mode – 4 Position Key Switch – 7 Function Link Gauge – AGI Module (digital to analog gauge interface) – Hot Foot ERC Conversion Kit
2.01.05 (EU SOP)	5.0L MCM 5.7L MIE/MCM 6.2L MIE/MCM	– Slim Binnacle Mount Control with Throttle Only Mode – ERC Mode Select (docking, single lever, shadow) – NMEA2000 Gateway – Foot Throttle Lock, AutoSync Off, and Trim Delta – Higher RPM limit on Troll Control

7 Function Link Gage

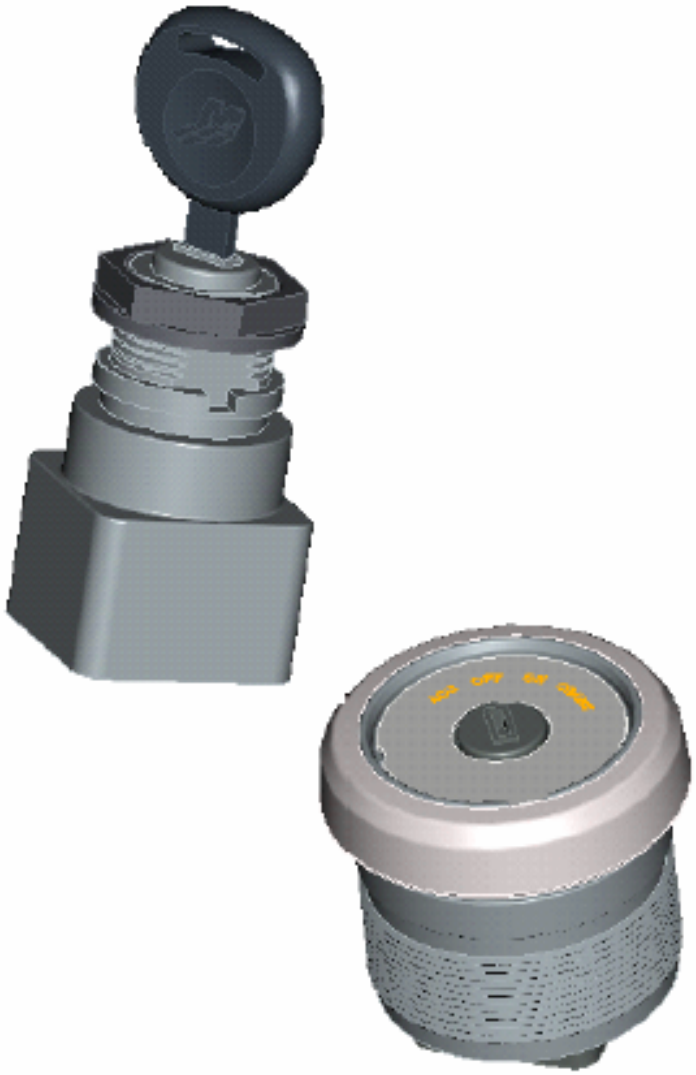
- **Project Definition**
  - Localize numerous boat warning indictors in one convenient package
  - Provide warning light indication for the following items:
    - Engine Temperature
    - Oil Level/Pressure
    - Water-in-Fuel
    - Water Pressure
    - Check Engine
    - DTS Faults
    - Battery Voltage
- **Benefits**
  - Similar to dash board warning lights available in the automotive industry
  - Provide more visual cues to the user about the status of the vessel
  - Can be used on lower-end systems to provide more information to user where an LCD-equipped SmartCraft gauge is not desired.
- **OEM Impact**
  - Another useful gauge offering from the SystemLink Gauge lineup
  - Allows even more customization in the gauge panel area to set yourself apart from the "other guys"
  - Serial installation with other SystemLink Gauges is fast and easy

Mechanical ERC Lockout



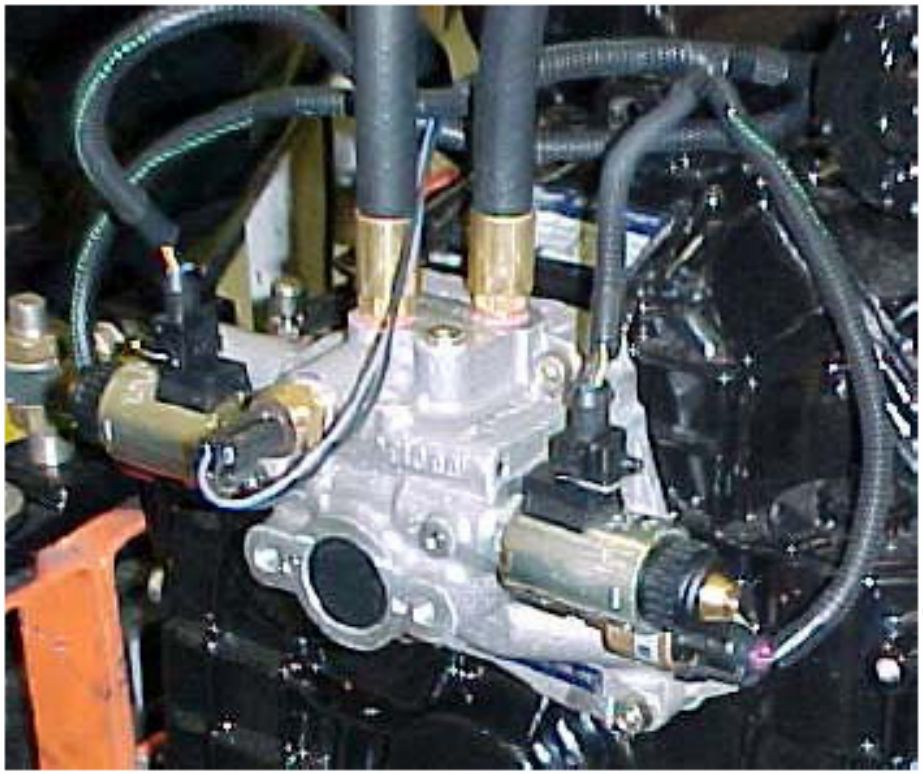
- **Project Definition**
  - Mechanical lockout for Panel Mount ERC provides immediate physical feedback to operator. Replaces electronic button lockout
- **Benefits**
  - Cable driven lock system
  - > 150 pounds force for neutral lock
  - Start/Stop button
  - Throttle only button
    - Horn chirp
    - Latch timer (1 sec)
    - Press once or hold to engage mode
- **OEM Impact**
  - Same physical installation, therefore impact is specifically increased functionality and marketing
  - Mechanical lockout increases safety
  - Start/Stop button on handle increases ease of operation, especially for tow-sport oriented activities

4 Position Key Switch



- **Project Definition**
  - Customer demand has resulted in the addition of a fourth position on the key switch so that it mimics the operation of the automobile as far as having accessories powered off of the key switch
- **Benefits**
  - Suppler: Asahi Denso
  - Accessory position added (Stop, Acc, Run, Start)
  - Redundant stop
    - E-stop grounded (ground to activate E-stop)
    - Removes 12V switched power (purple)
    - Need both to start the engine
  - Water Sealed
  - High Temp Grease
  - Positive Detent / Return Spring
  - 1" Panel Thickness Capability
  - Key Attributes
    - Over-molded plastic allows for customer-specific logos
  - Color match gauge bezel available
- **OEM Impact**
  - Key is physically larger than 3-position version
  - Only one flat on the horizontal (top) as compared to two flats in the vertical for previous version, therefore panel cutout may need to be updated
  - Better sealed switch increases robustness and reliability
  - Key can be customized with OEM logo for brand identity

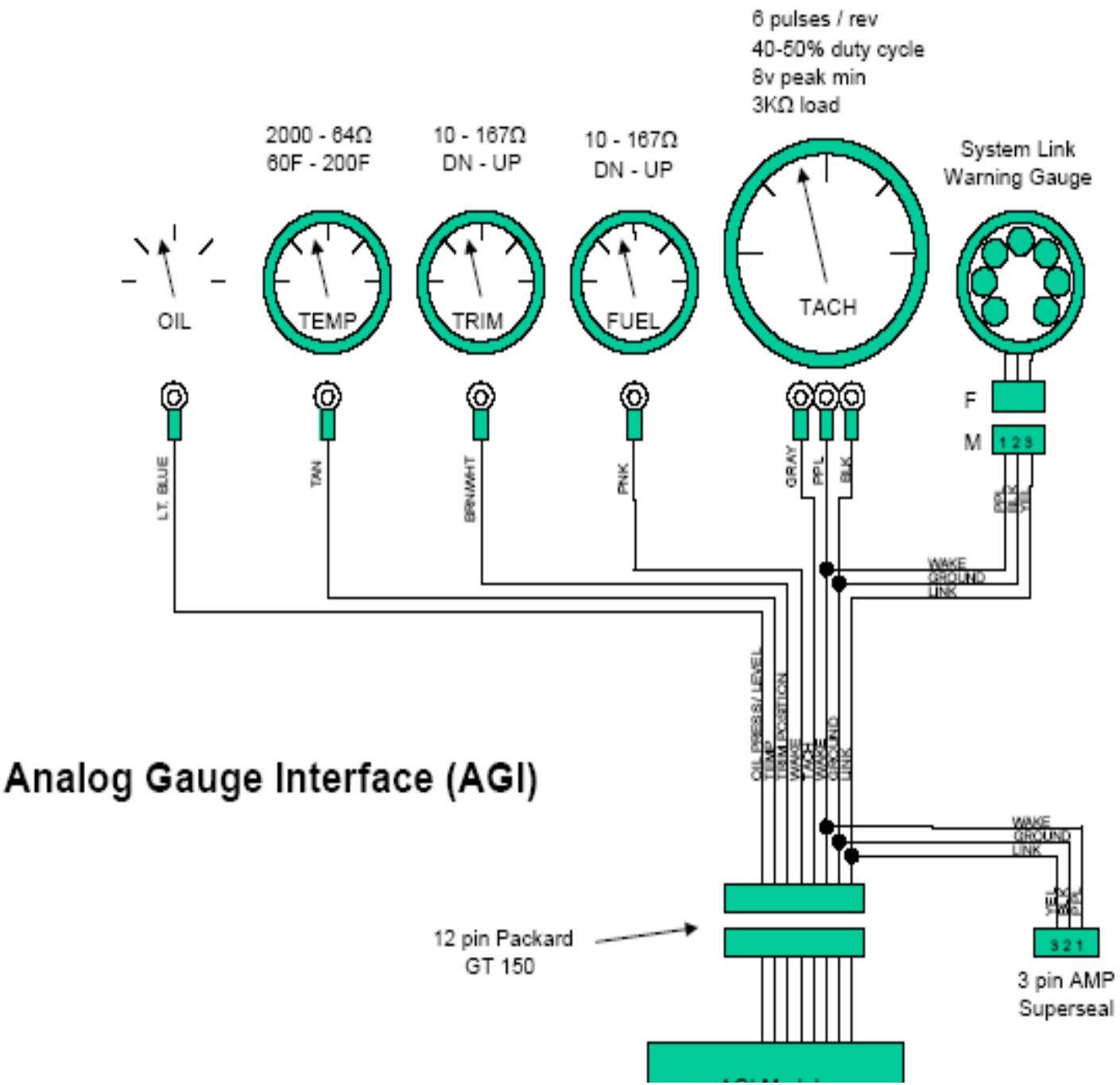
DTS MIE ELECTRONIC SHIFT BLOCK



- **Project Definition**
  - An electronic shift body replaces the mechanical shift body on the DTS MIE engines. This shift block operates by using integral springs to center the hydraulic valve to the neutral position. When the forward or Reverse continuous duty solenoids are energized with 12 VDC, they overcome the spring constant to move the hydraulic valve to its desired position. 12 VDC applied to the opposite solenoid will engage the clutch for the opposite rotation. When no voltage is applied to either solenoid, the springs position the hydraulic valve to the neutral position. Feedback from the transmission is accomplished with pressure sensors for the hydraulic circuits and an high temperature switch which supply inputs for Transmission Guardian operation.
- **Benefits**
  - True digital shift control for inboards
  - Transmission Guardian
  - Simplified operation for ease of servicing
- **OEM Impact**
  - Nothing to connect or rig (other than plugging in the temp switch connector)

Analog Gauge Interface (AGI) (892486K01)

- **Project Definition**
  - The function of the AGI is to receive CAN digital information from the engine controller (via VDO's link communication) and convert it into analog gauge commands at the helm.
  - The AGI module is be capable of driving an analog tachometer, oil pressure, trim position, engine temperature, and fuel level, in addition to any of the SmartCraft System Link gauges.
- **Benefits**
  - DTS systems can operate with any gauge interface the OEM/customer chooses
- **OEM Impact**
  - Even more options to offer for DTS engines so that OEMs can differentiate themselves for brand identity



Analog Gauge Interface (AGI)

System Link Adapter Kit (84-892821K01)

- **Project Definition**
  - Engine PCM now can stream System Link gauge data
  - Provide a means for the OEM to use SC100 System Link gauges without the need for an intermediate SC1000/SC5000 LCD driver gauge
  - Requires Tach Link to be enabled on the engine PCM with SPX software
- **Benefits**
  - Significantly reduces the cost to use the SC100 Link gauges since an LCD driver gauge is no longer required
- **OEM Impact**
  - Now even the smallest runabout can be equipped with SmartCraft gauges
  - SC100 Link gauges install very rapidly: just connect the 3 pin connector from one Link gauge to the next (serial communications)

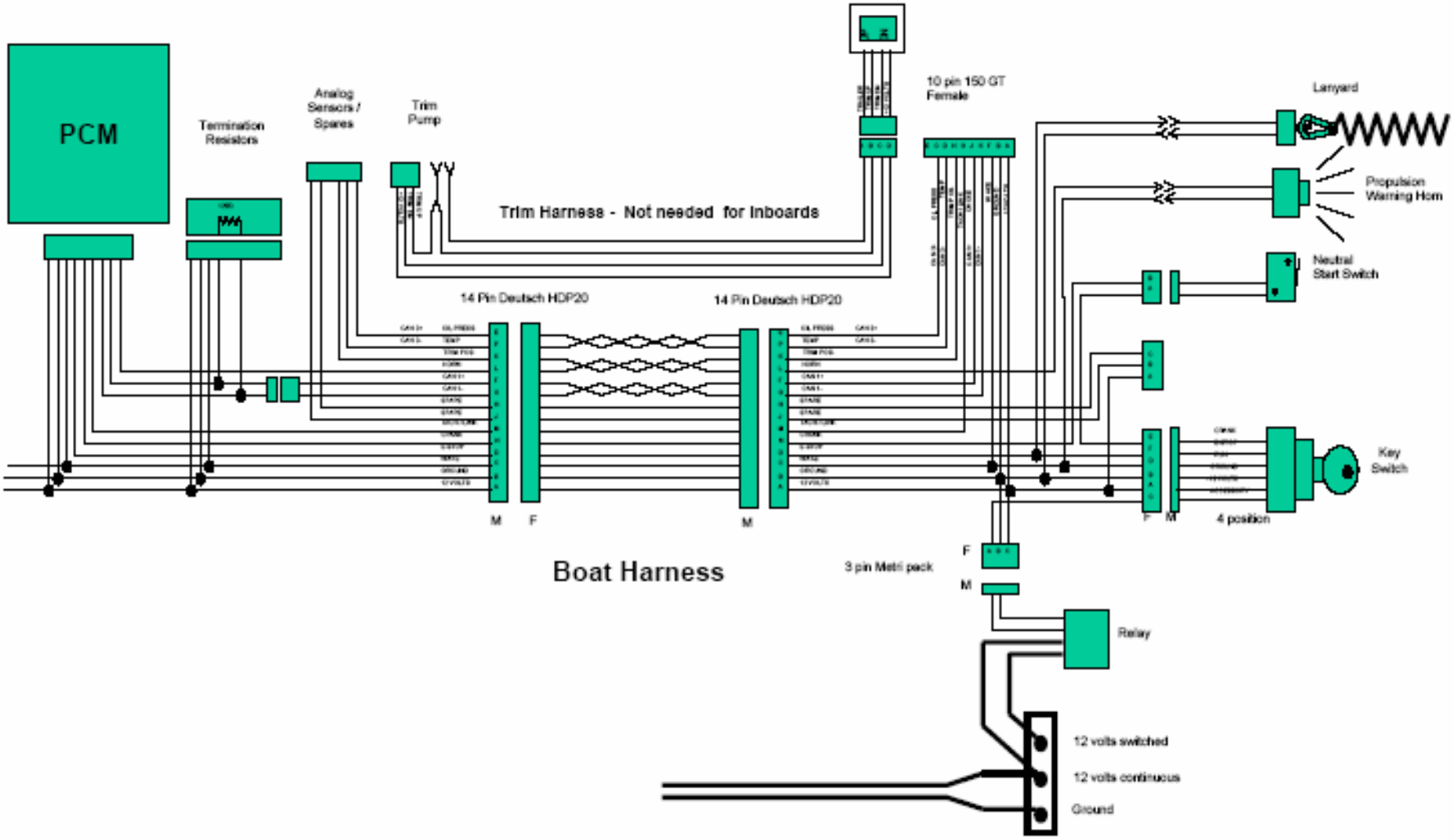
TACH LINK

- **Project Definition**
  - Tach Link is a system which allows the tachometer output of the PCM to provide either conventional analog tachometer data (default), or serial data to operate Mercury SC100 System Link gauges or drive the AGI module. The Tach Link wire is to be used in conjunction with a power wire and a ground wire to provide a 3 wire system which connects directly to existing SC100 System link gauges via the System Link Adapter Kit. The Tach Link PCM output is configurable using the CDS laptop (SPX software) tool when connected to the diagnostic port of the engine.
- **Benefits**
  - Numerous gauge options for the same engine platform

- **OEM Impact**
  - Even more gauge options available for each boat/engine combination
    - Analog
      - Analog only gauges (AGI)
      - Analog and digital gauges (AGI and SC100 gauges)
    - Digital
      - SC100 System Link gauges (System Link Adapter Kit)

Non-DTS Harnessing

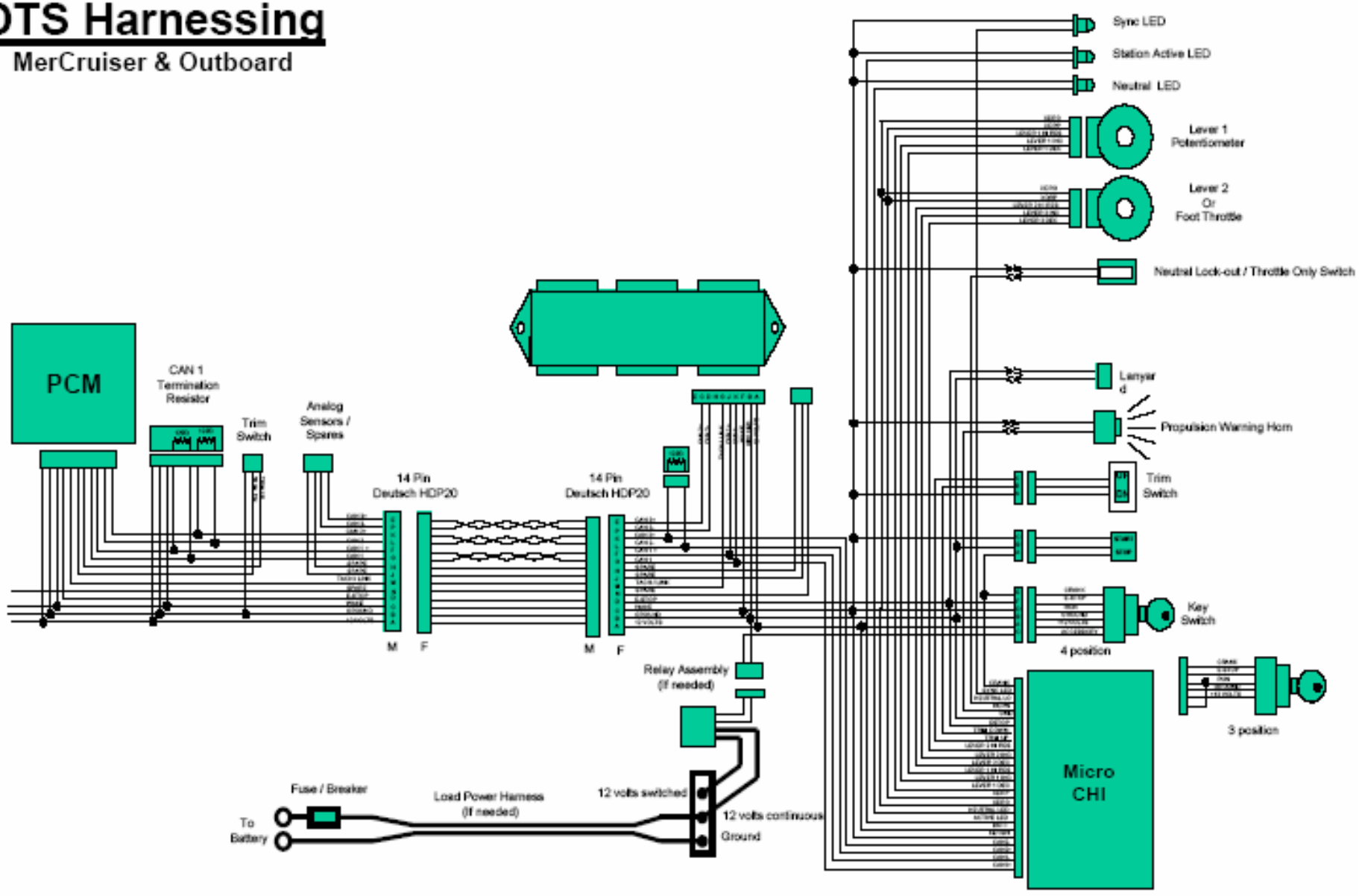
MerCruiser



8/11/2004

DTS Harnessing

MerCruiser & Outboard



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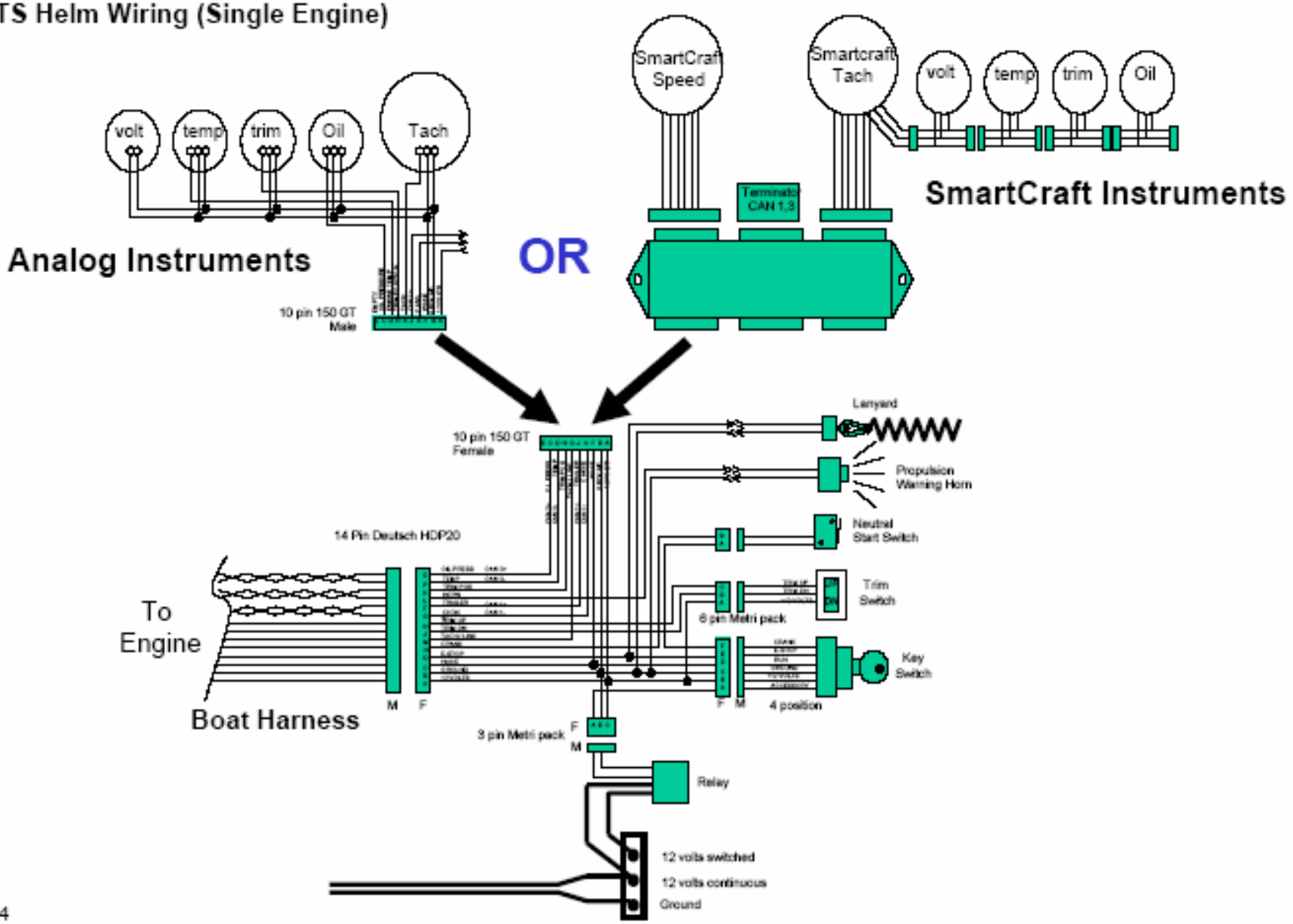
SmartCraft Generation II

Non-DTS Helm Wiring (Single Engine)



8/11/2004

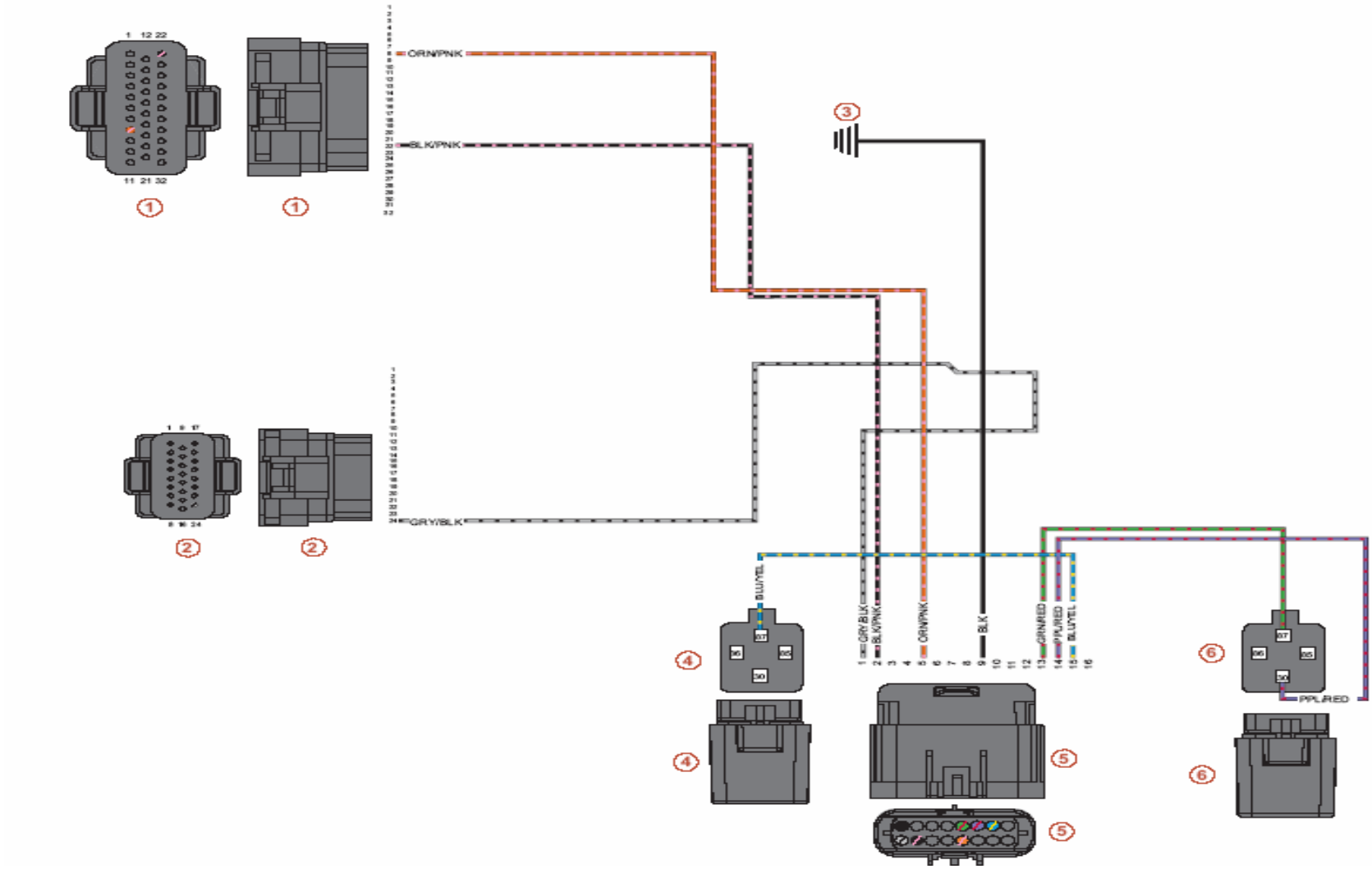
5.0L MPI – BRAVO DTS

Engine Block: GM 5.0L
Engine Controller: PCM 03
Fuel Injection: Sequential Fuel Injection
TBU: 80mm Electric
Flame Arrestor Flow: 500 CFM @ 1 in Hg Manifold and 28” Hood Pressure
Maximum Flame Arrestor Height From Crankshaft: 557 mm
Rated Crankshaft HP: 260 Horsepower
Rated WOT Speed: 4600-5000 RPM
Transom Type: Bravo, Analog & Digital Sender, Magnum, Exhaust Tube
Available Options

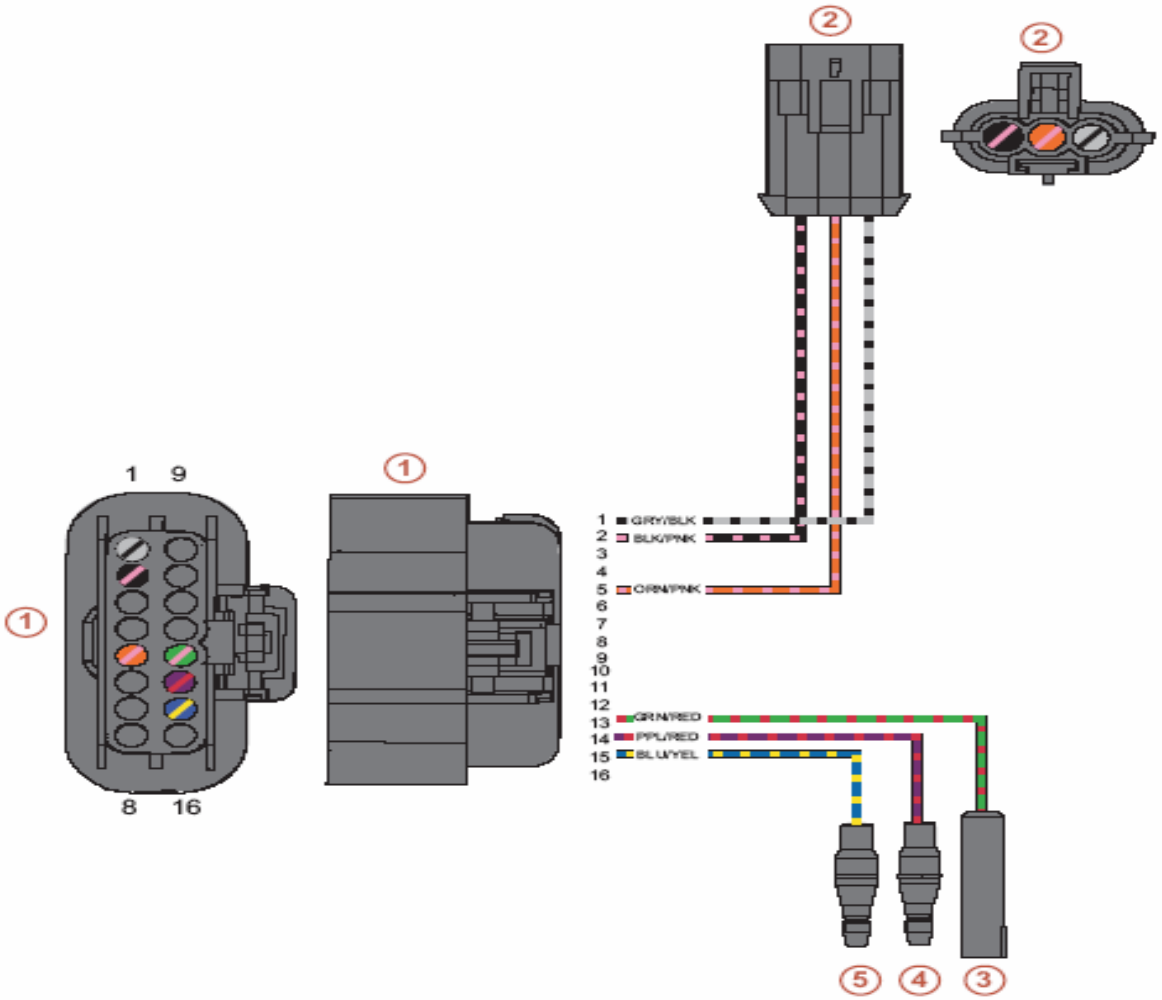
Bravo 1: 1.65 (P), 1.50 (O)
Bravo 2: 2.20 (P), 2.43 (H), 2.00 (O)
Bravo 3: 2.20 (P), 2.43 (H), 2.00 (O)
FWC: Full System, Exhaust Manifolds Included, Air Actuated Water Drain STD
RWC: With Air-Actuated Water Drain
RWC: With 3-Point Drain
3” Risers
6” Risers
Jackshaft Ready
CHS: Compact Hydraulic Steering

496/8.1 DTS/ Mech. 17 pin Transom harness Part # 84-865677a01

Typical MerCruiser DTS Trim Circuit

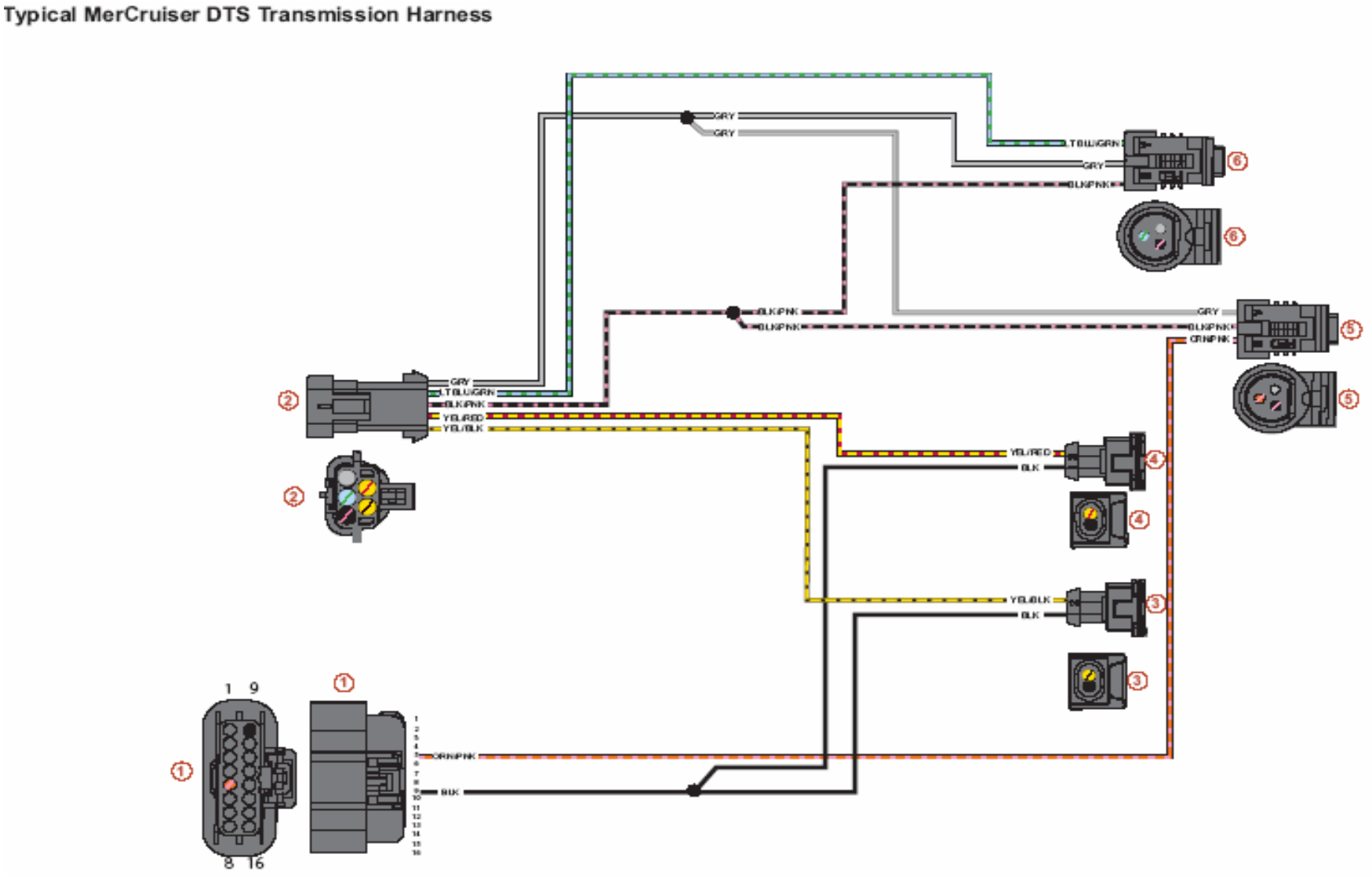


Typical MerCruiser DTS Trim Harness



8.1 MIE DTS 17 pin transmission harness, ZF Hurth part # 84-865676a01

Typical MerCruiser DTS Transmission Harness



8.1 MIE mech. 17pin transmission harness, part #84-865769a01

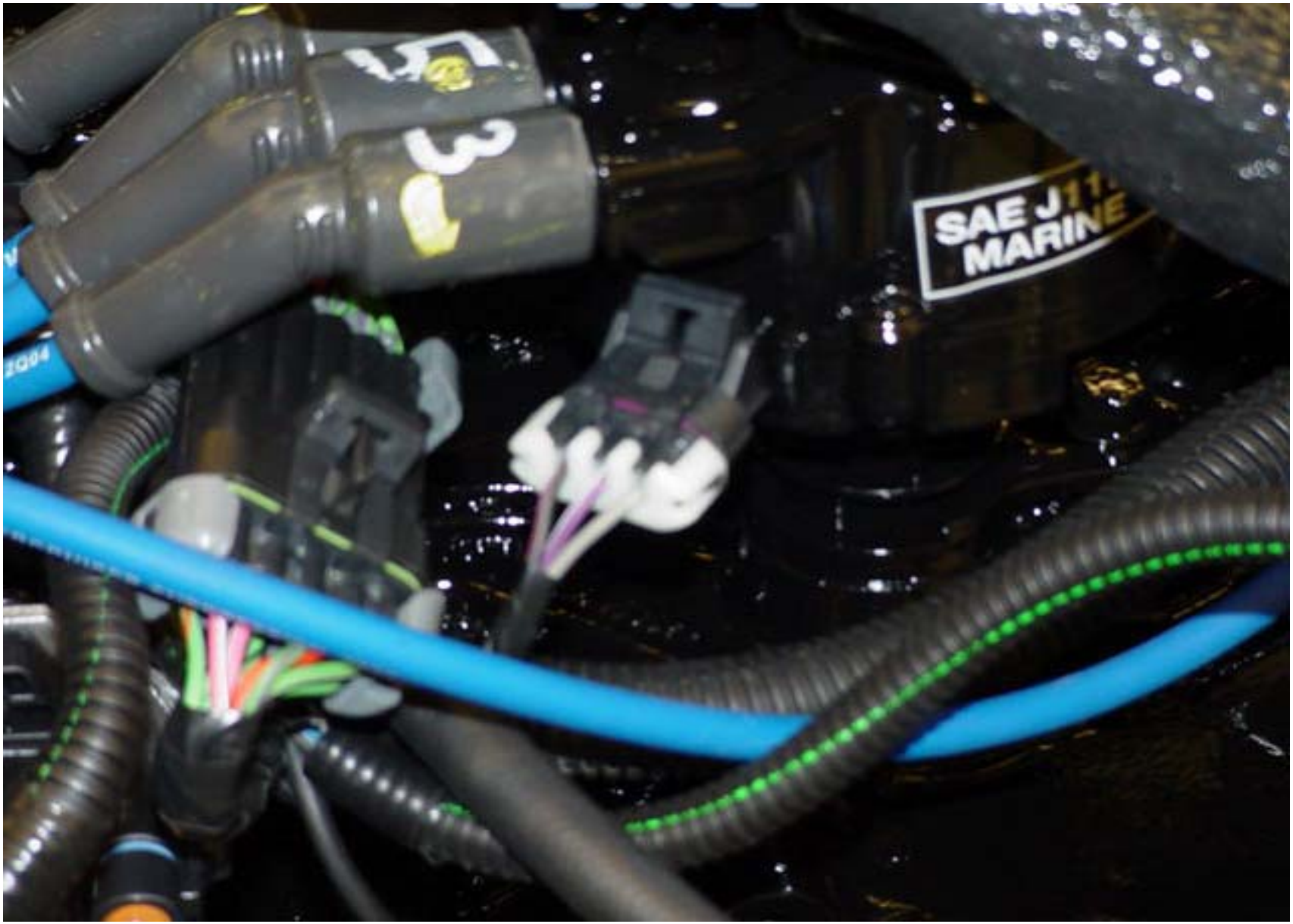
Over view of the 5.0 DTS engine

5.0 shift actuator same as 496

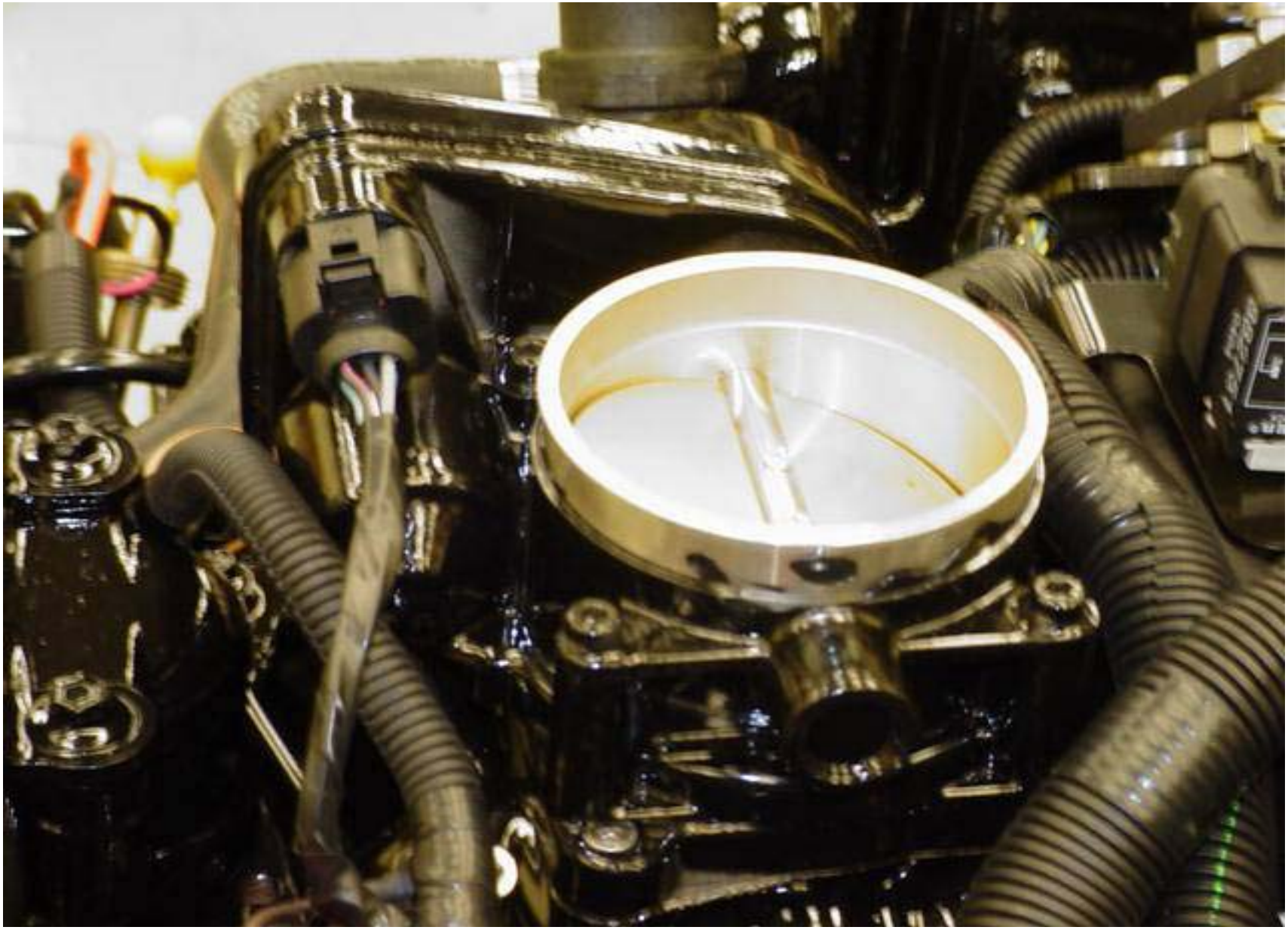
From left to right; 4 pin diagnostics, 6 pin paddle wheel /fuel tanks,17 pin transom harness and 2 pin clean power
top of bracket 14 pin Deutsch

Termination Resistors Can 1 Yellow Can 2 new Blue

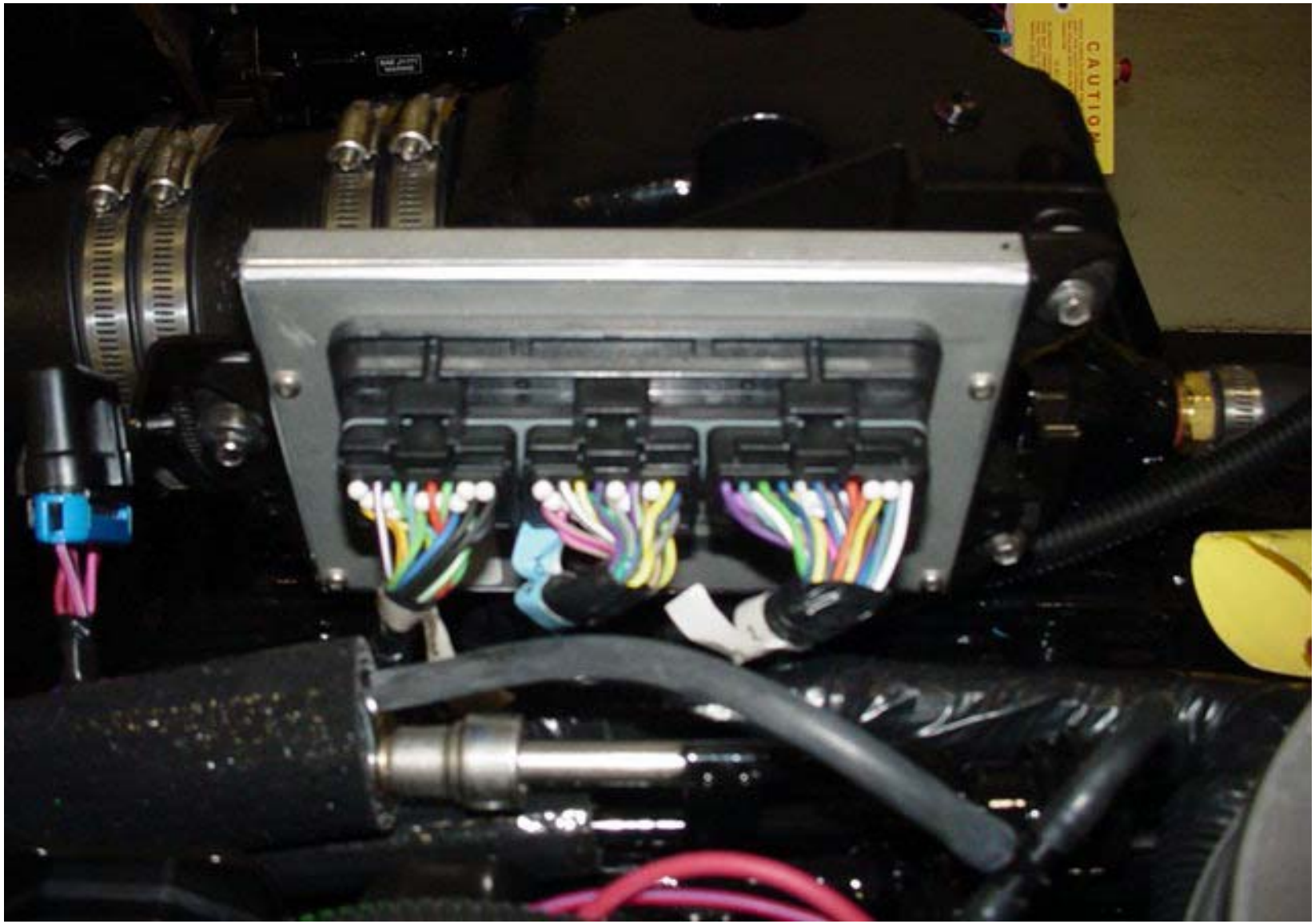
HVS Cam sensor location used on Small Block DTS



80 MM Electronic Throttle Body same as 496/8.1 DTS

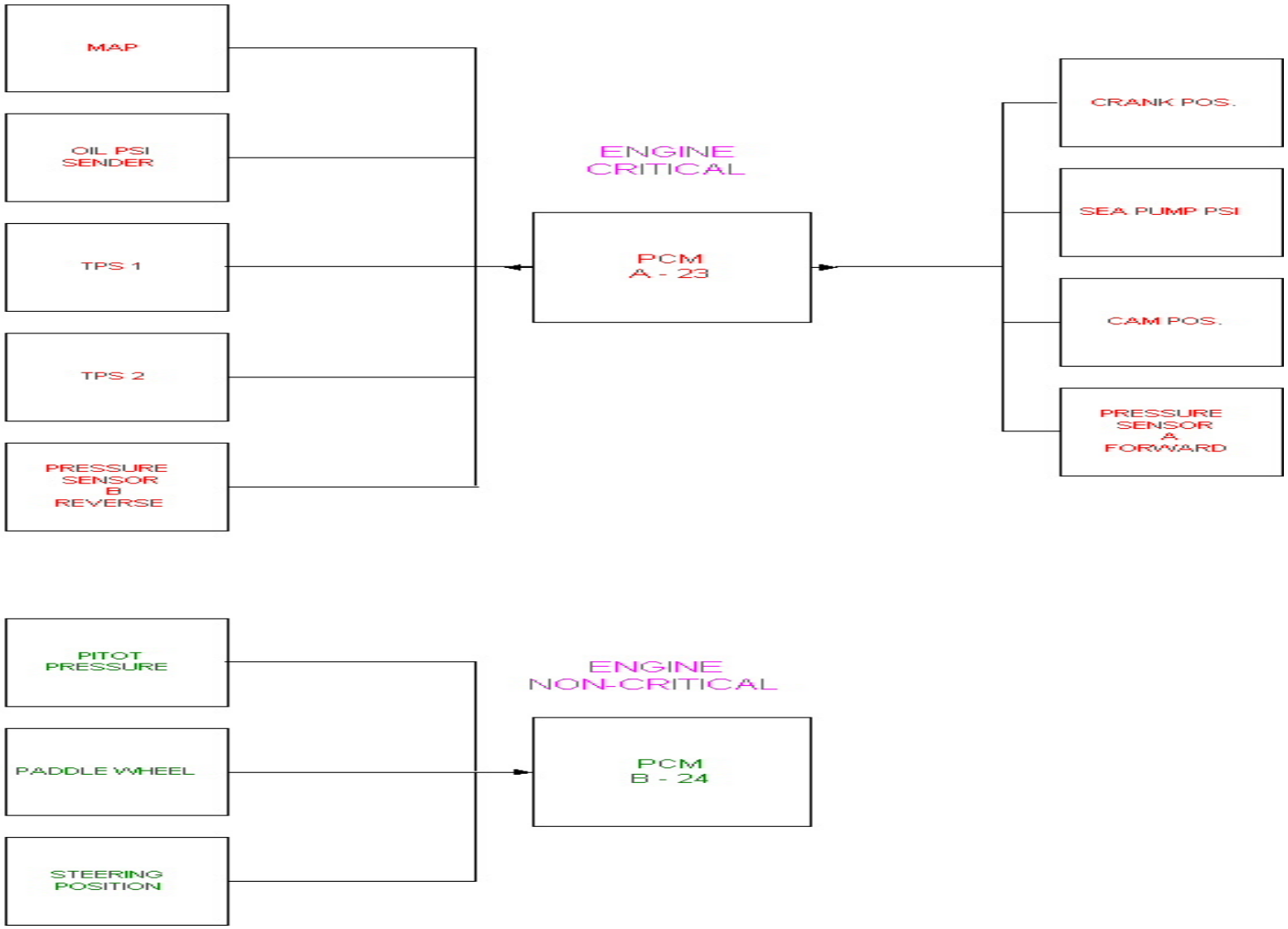


PCM 03 controller uses box part number 885558 same as used on 496/8.1 DTS engines

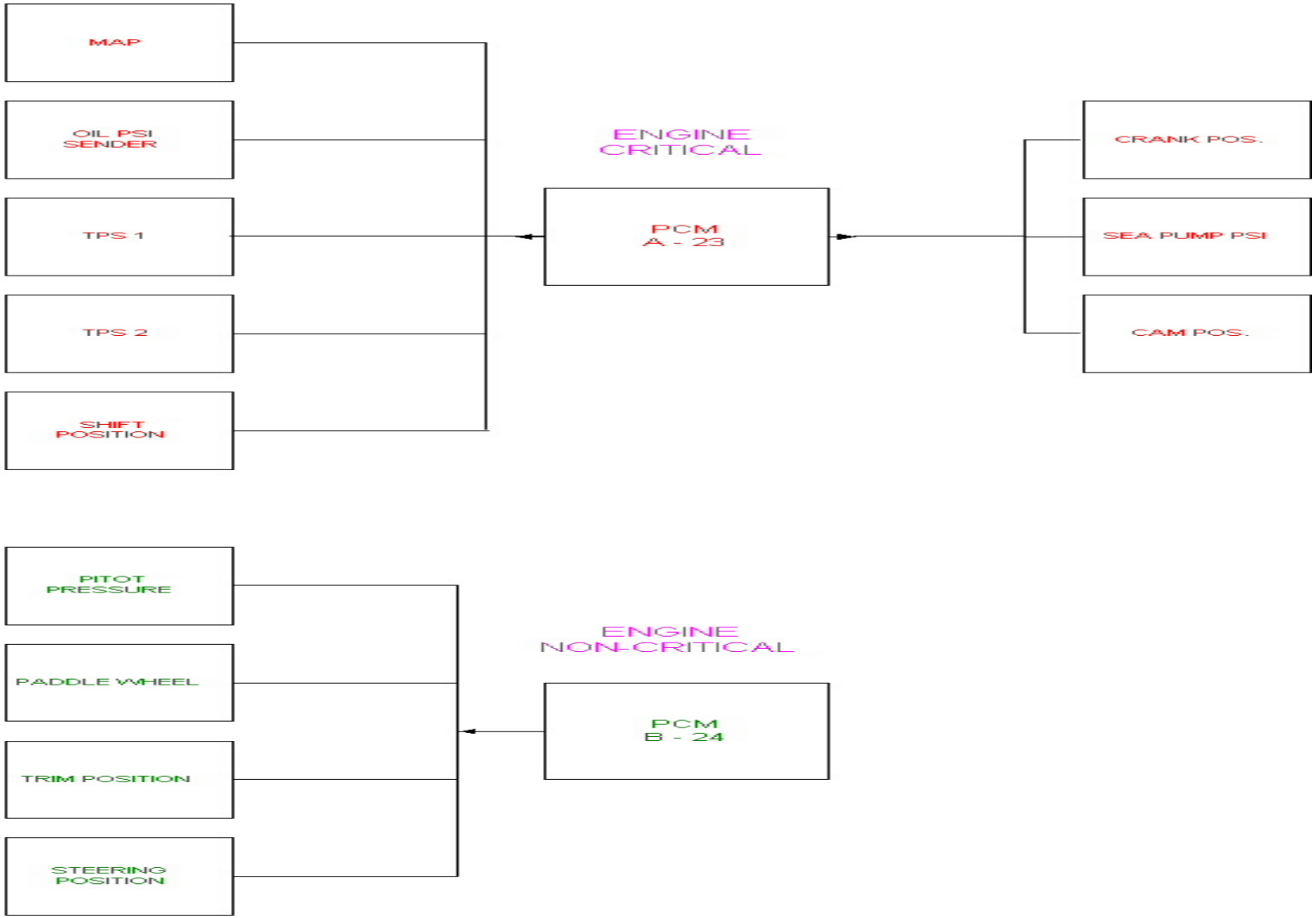


5 Relays used from left to right Trim down /Trim up /Fuel pump Main Power/Start relay. Small block DTS are used with Bravo Transom assy, with 3 wire SmartCraft Trim sender

PCM 03, 5 VOLT POWER SPLIT MIE DTS



PCM 03, 5 VOLT POWER SPLIT MCM DTS



MERCURY MerCruiser

Service Bulletin

☐ Warranty Information ☑ Service Information Bulletin No. 2003-14
☐ Parts Information

Circulate to: ☐ Sales Manager ☐ Accounting ☑ Service Manager ☑ Technician ☑ Parts Manager

Service/Repair of Electrical Test Equipment

Notice
This bulletin replaces MerCruiser Service Bulletin 97-13.

Test Equipment

All electrical test equipment must be returned to the vendor or repair facility for service repair and/or replacement parts. Any electrical test equipment received in Fond du Lac shall be returned to the sender. We encourage contact with the business prior to shipping the unit to obtain shipping, estimate and repair details. The addresses and phone numbers are following.

Vendor	Equipment	Part Number
Electronic Specialties, Inc. 2449 Pierce Drive Spring Grove, IL 60081 (815) 675-1812 Fax (815) 675-2905	Timing Light (self-contained)	91-99379
	Multi-Meter/DVA	91-99750
	Merctach Digital Tachometer	79-17391A1
	EFI Tester	91-11001A2

NOTE: *Digital Volt Meter is not serviceable. Purchase a good quality 10 meg ohms impedance. Not using 10 meg ohms impedance, may not allow EFI tester to normalize.*

Vendor	Equipment	Part Number
Merc-O-Tronic Service Department 215 Branch P.O. Box 488 Almont, MI 48003 (810) 798-8555 Fax (810) 798-2222	Tach/Dwell Meter	91-59339
	Ignition Analyzer	91-76032

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Vendor	Equipment	Part Number
Not available. Replacement parts are not available.	Thunderbolt Ignition Analyzer	91-62563A1
	VOA Meter	91-62562
	Mark 1 Tester	91-64645A1

Vendor	Equipment	Part Number
SPX Corporation 2300 Park Drive Owatonna, MN 55060 (800) 344-4013 International: (586) 574-2332	Digital Diagnostic Tester (DDT)	91-823686A 2

NOTE: *Any electrical test equipment received in Fond du Lac shall be returned to the sender.*

Vendor	Equipment	Part Number
Blue-Point Products 9615 SW Allen Blvd. Ste 104 Beaverton, OR 97005 (888) 382-6522	DMT-2000 Digital Tachometer Multi-meter	91-854009
	DMT-2000A Digital Tachometer Multi-meter	91-854009--3

NOTE: *Please call and make repair arrangements prior to sending meter. Blue-Point Technical and Customer Service office hours: 8:00 AM - 5:00 PM Pacific Time Zone.*

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MERCURY MerCruiser

3

2005
Product Update

Section 3

Exhaust and Cooling Systems

Table Of Contents

MerCruiser Dry Joint Exhaust and Cooling System - V6, V8 Small Block

MCM Exhaust Elbow Height Change

MerCruiser

Dry Joint

Exhaust and Cooling System
V6, V8 Small Block

Strategy Behind MerCruiser Exhaust System Changes

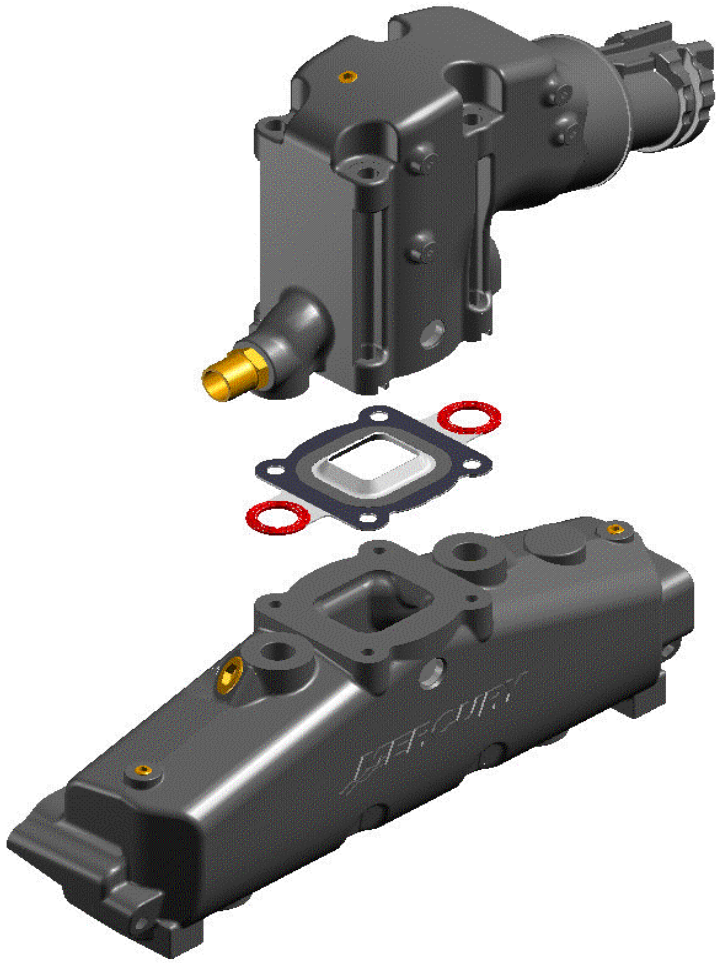
- Prevent Coolant Leaks.
- Eliminate Water from Leaking into Exhaust Passages.
- Help Prevent Reversion.
- Insure More Robust Exhaust Collection & Muffling System.

Start of Dry Joint System

- MCM V6 Models: S/N 0M615000-UP.
- MCM V8 Models: S/N 0M600000-UP.
- MIE V8 Models: S/N 0M0317000-UP.

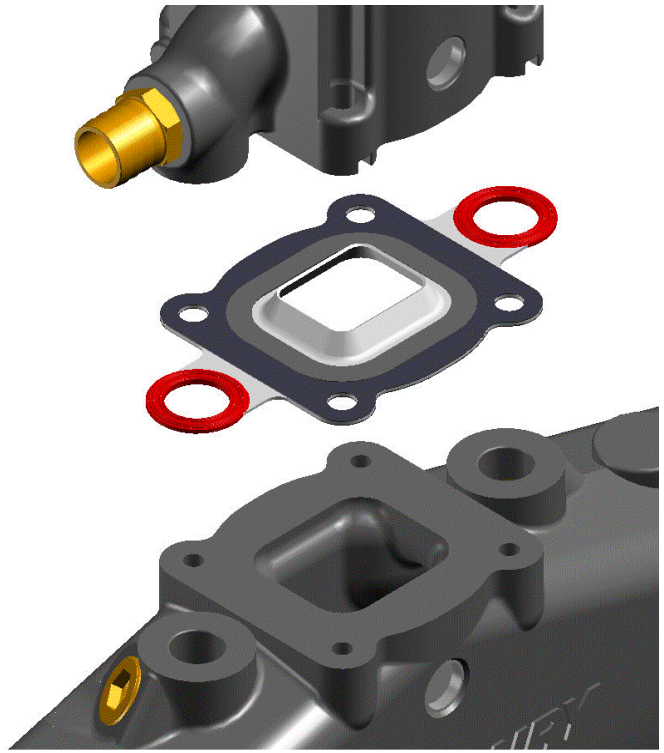
Dry Joint Design Changes

- New Exhaust Manifold.
- New Exhaust Elbow.
- New Gaskets.
- New Risers.



Dry Joint Gaskets

- Built-in Turbulator
  - Traps Condensation From Elbow
  - Traps Water Reversion
  - Increases Local Flow Velocity
- Water & Exhaust Separated
  - Better Sealing
  - No Leakage into Exhaust

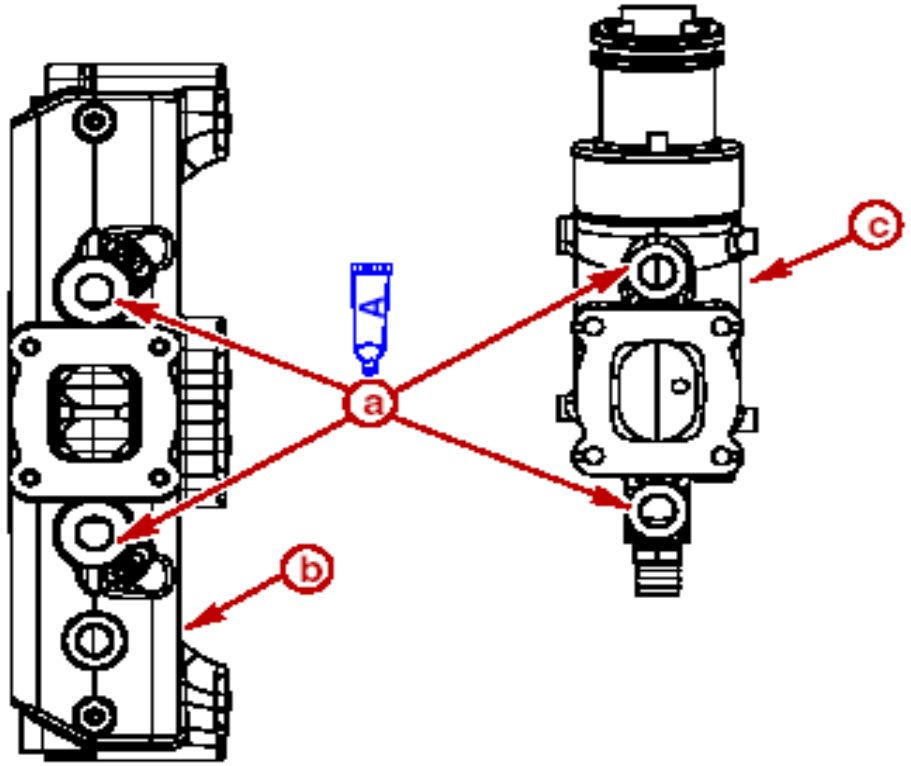


Dry Joint Gaskets

- New Materials
  - 18 gauge 316 ss Core.
  - Two Layer 5000° F Grafoil™, Seals Exhaust Passage.
  - High Temp 4 Bead Silicone Seals Water Ports.
  - Perfect Seal Protects Manifold and Elbow.

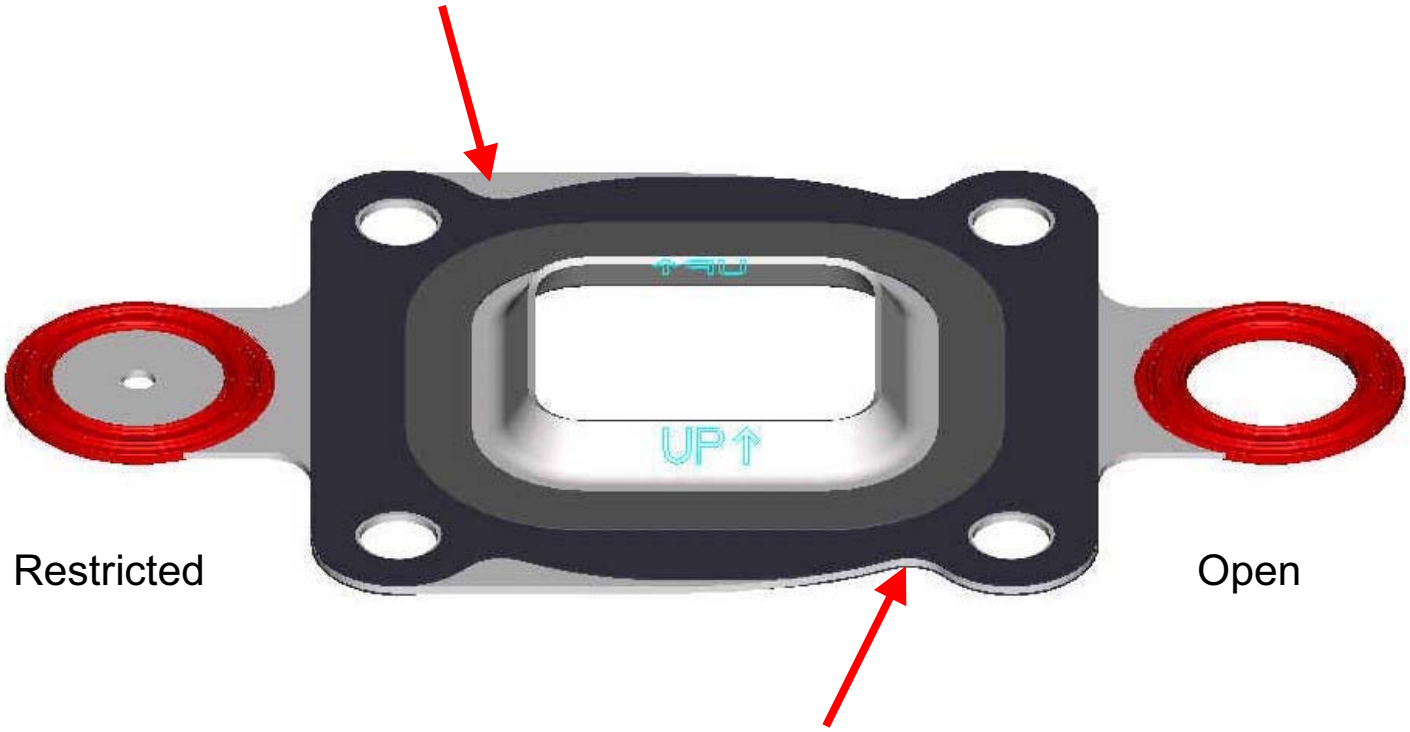
Dry Joint Gaskets

- Coat Edge of All Water Ports with Perfect Seal.
- If Bare Metal on Gasket Surface, use Perfect Seal.



Restrictor Gasket

Restrictor End of Gasket is Straight



Restricted

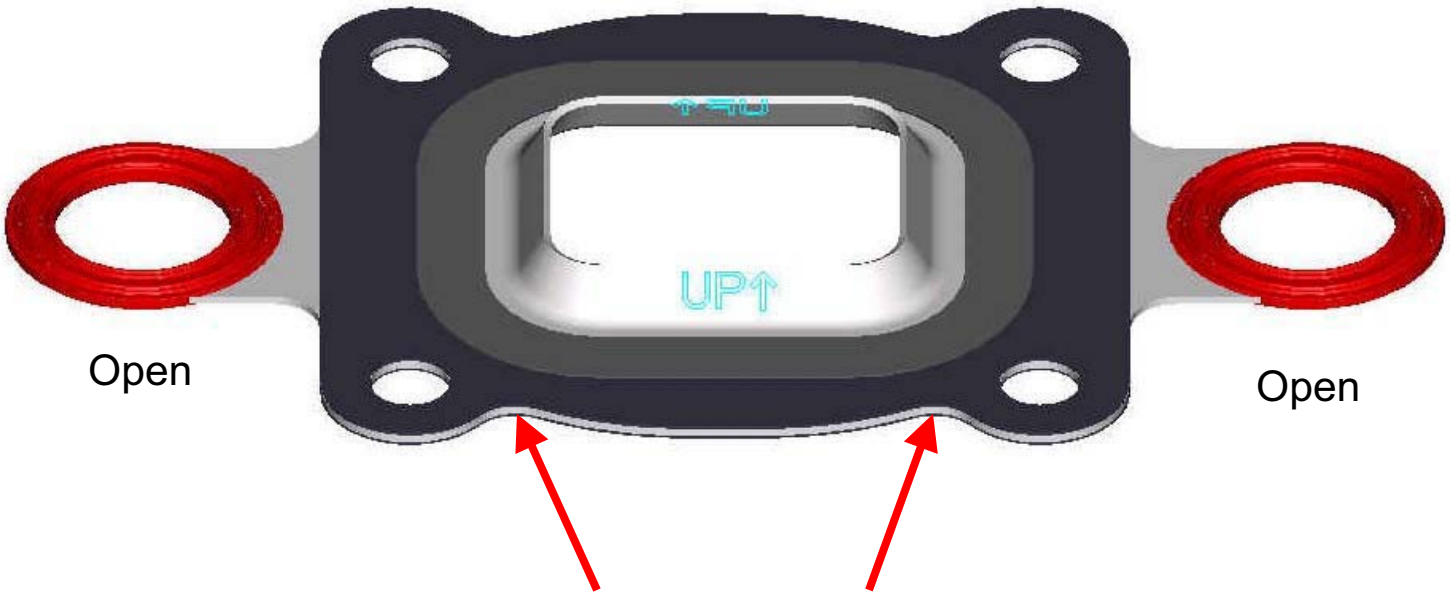
Open

Open End of Gasket is Contoured

Restrictor Gasket

- Used on All Raw Water Cooled Engines on the Manifold.
- Restrictor Opening Goes Toward End That Bypass Water Comes From Thermostat Housing Into Exhaust Elbow.
- Turbulator Points Upward.

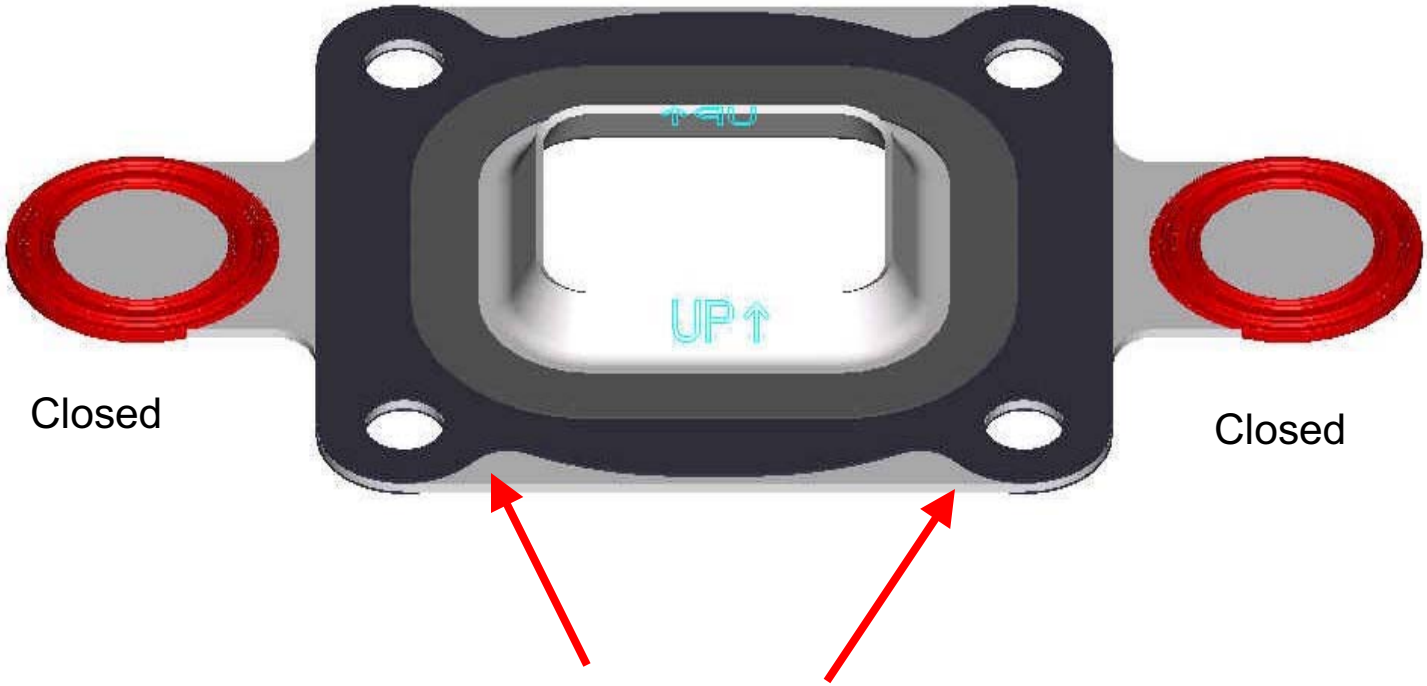
Full Flow Gasket



Full Flow Gasket

- Used on All Engines with Risers.
- Goes Between the Riser and Exhaust Elbow.
- Turbulator Points Upward.

Block Off Gasket



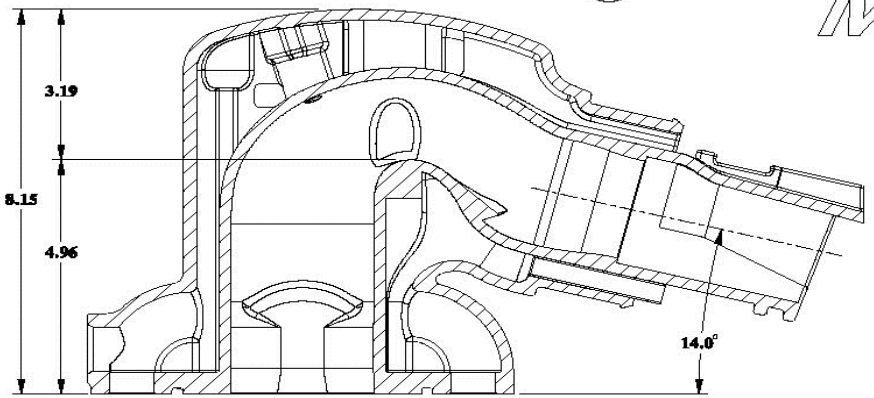
Block Off Gasket

- Used on All Closed Cooled Engines.
- Goes Between the Exhaust Manifold and Riser.
- Turbulator Points Upward.

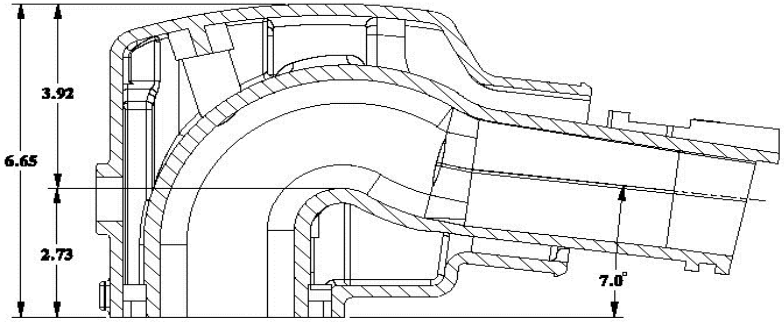
Installation Reminder

- Current MIE Inboard and Tow Sports V-Drive Requirements.
  - Test & Verify Exhaust System Designs
  - 6.9-13.7 kPa (1-2 psi) Exhaust Back Pressure.
  - Maintain Adequate Support of System Components.
  - Use Exhaust Resonators if They Help.
  - Use at Least Minimum Size Exhaust Hoses.
  - Use Heat Resistant Exhaust Hose.
  - Use at Least 2 Clamps per Connection.

Dry Joint 14° Exhaust Elbow



NEW MIE ELBOW



OLD MIE ELBOW

Dry Joint Service Manual

- Nbr 37 V8 Service Manual Supplement.
  - 90-864260020 Oct 2002.
- Section 6 Cooling System.
  - All Models.
  - Seawater System.
  - Closed Cooling System.
- Section 7 Exhaust System.
  - Manifolds and Elbows.
  - Cold Riser Models.
  - Warm Riser Models.
- Section 10 Color Diagrams.
  - Water Flow Diagrams.

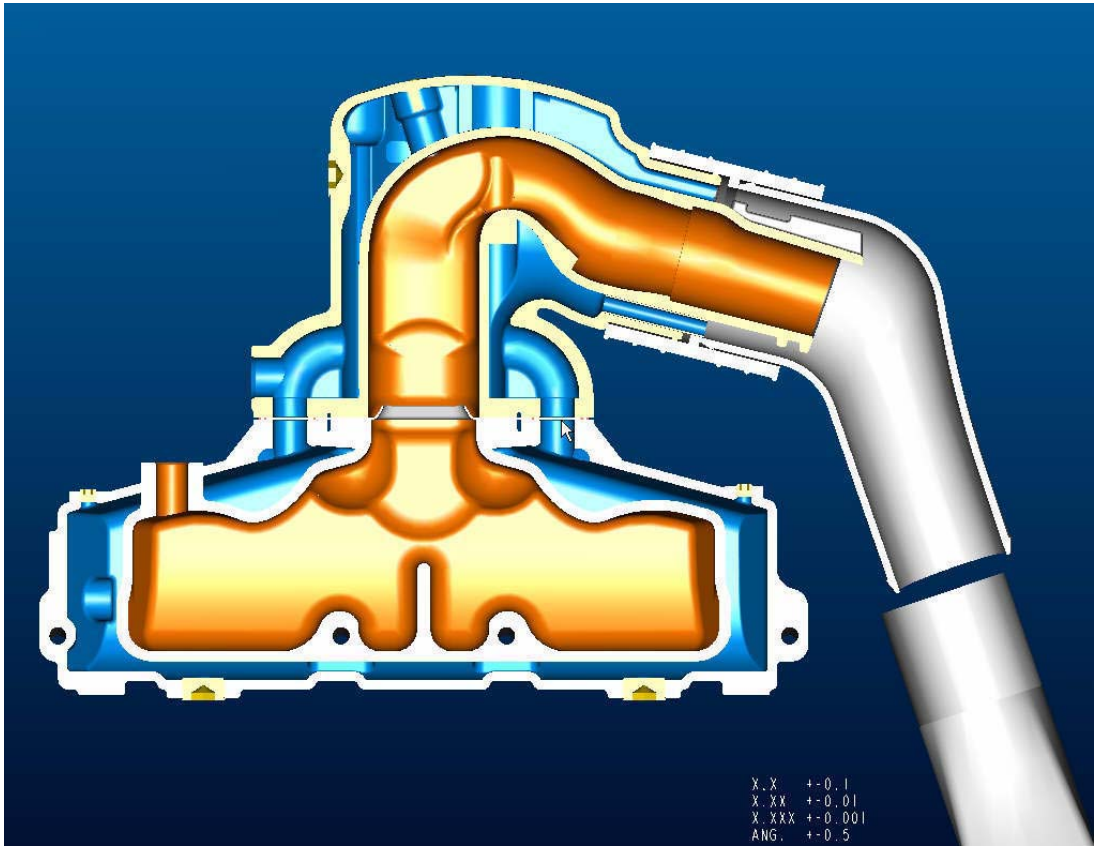
MCM Exhaust Elbow Height Change

- Project Objectives
  - Provide V-6 and S.B. V-8 MCM engines with increased elbow height
  - Increase exhaust elbow outlet angle
  - Create 1.7 inch riser for applications that would necessitate an engine box redesign
  - Provide 6 inch riser kit for V-6
  - SOP date by November 2004

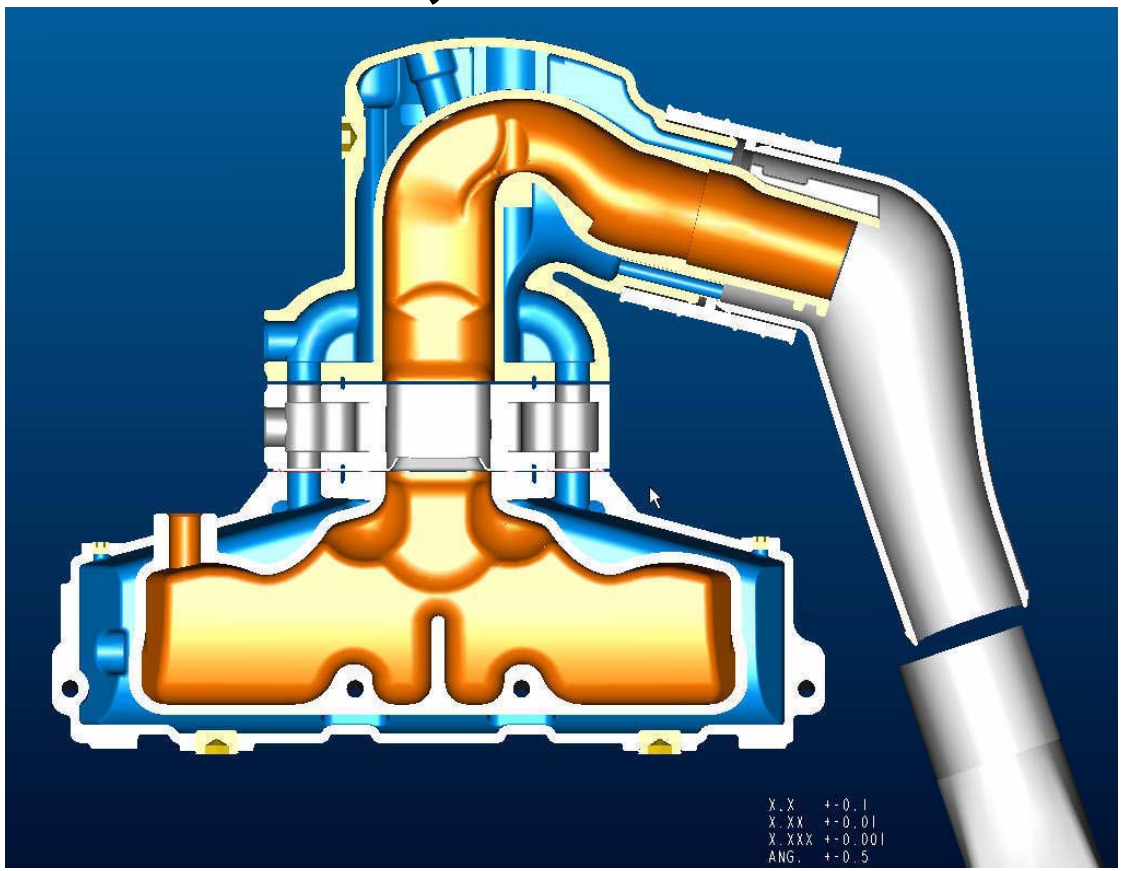
Exhaust Elbow Height

- System Overview
  - Current MIE elbow will become standard on all V-6 & S.B. V-8 MCM's except inline ski
    - Increases height by 1.5 inches over current MCM
  - Factory option for 1.7, 3 & 6 inch risers for MCM and 3 & 6 MIE
  - New intermediate exhaust pipes required
    - Individual pipes for each elbow/riser height

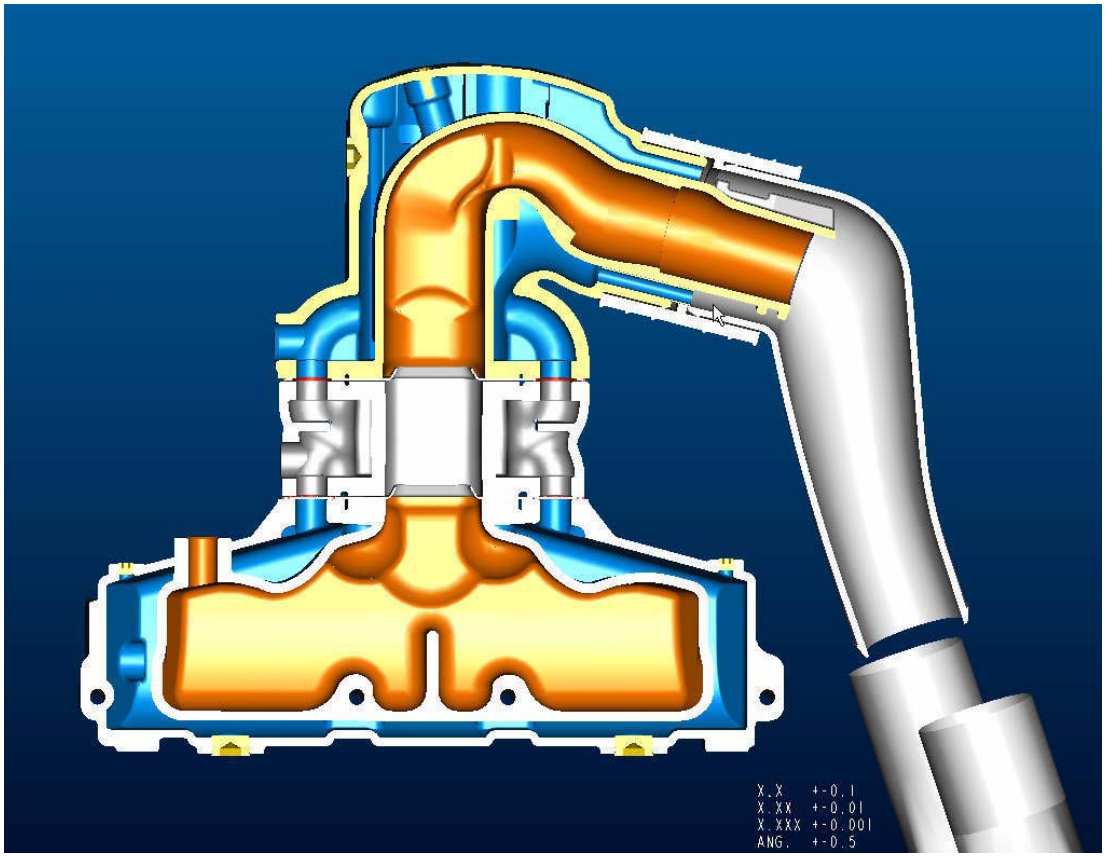
Exhaust Elbow Height 1.5”
Elbow Only



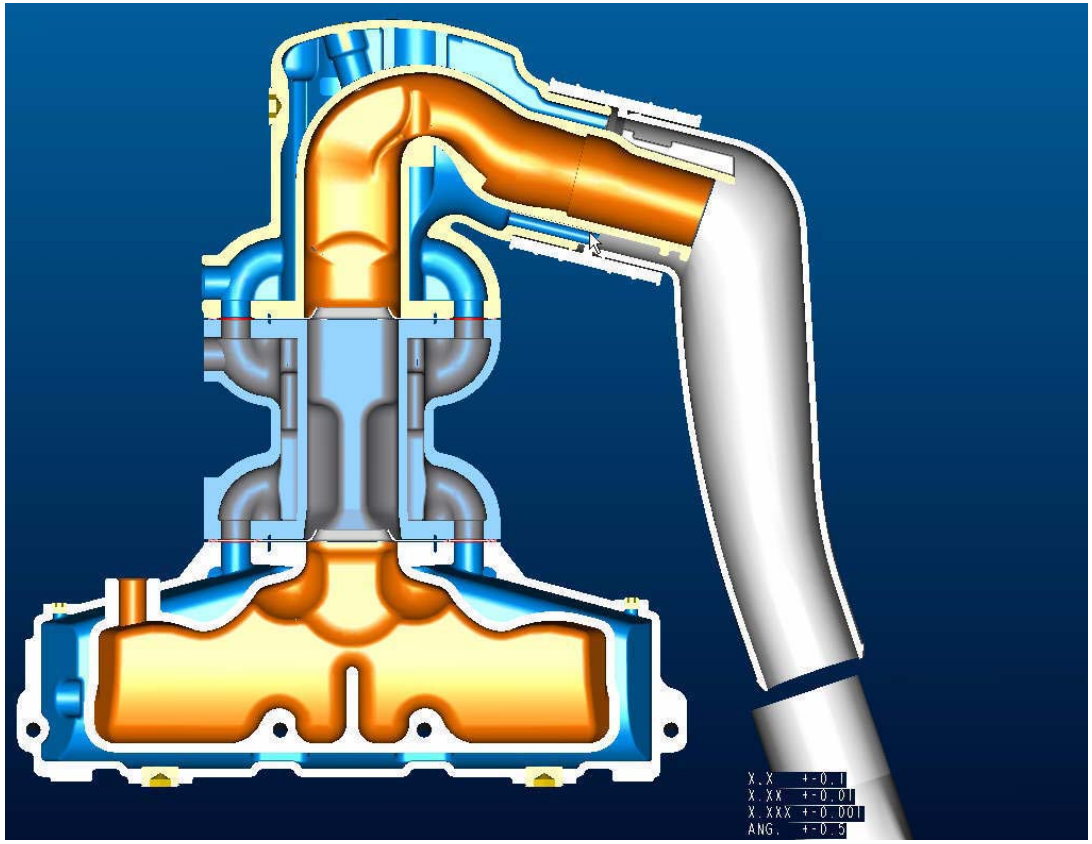
Exhaust Elbow Height 3.2” Elbow, 1.7” Riser



Exhaust Elbow Height 4.5” Elbow, 3” Riser



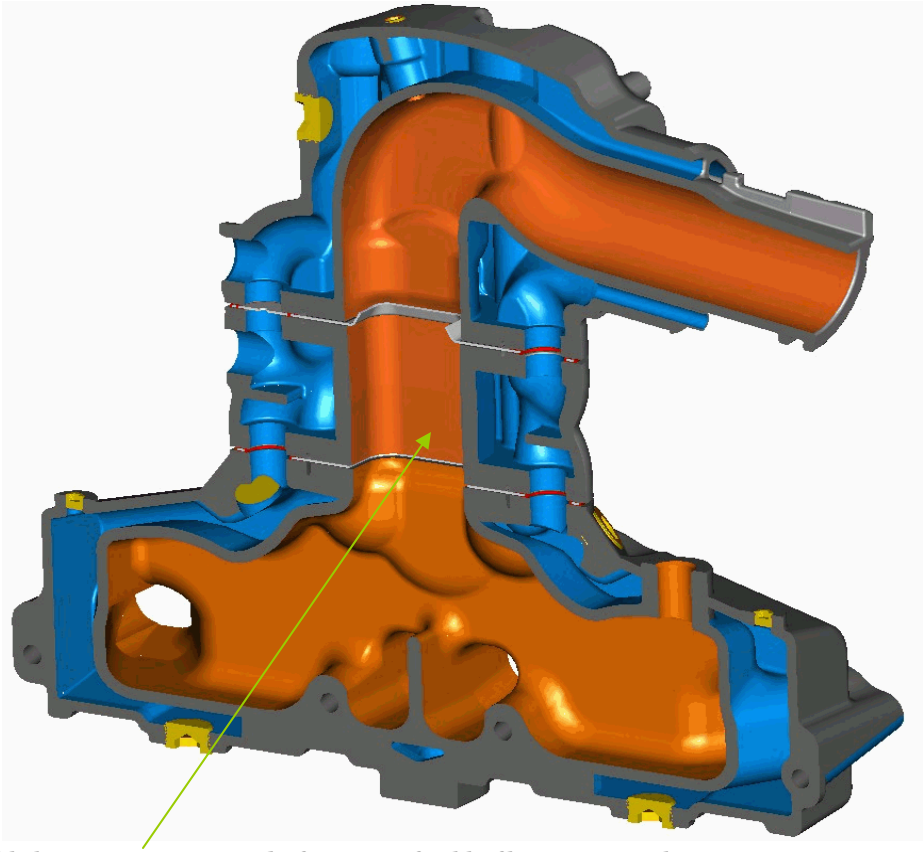
Exhaust Elbow Height 7.5” Elbow, 6” Riser



Exhaust Elbow Height Summary

Exhaust Elbow or Elbow / Riser Combination	External Δ Height (in)	Overall Δ Height (in)	V6 MCM Models	SB V8 MCM Models	SB V8 Inboard Models (either rear or fwd facing exh)	SB V8 Towsports Models w / Rear Facing Exhaust	SB V8 Towsports Models w / Fwd Facing Exhaust
864591 (tall) Exhaust Elbow Only	1.50	1.81	standard	standard	standard	N/A	standard
864591 (tall) Elbow + 1.70" Riser	3.20	3.51	factory option	factory option	kit	N/A	kit
864591 (tall) Elbow + 3.00" Riser	4.50	4.81	factory option	factory option	factory option	N/A	N/A
864591 (tall) Elbow + 6.00" Riser	7.50	7.81	kit	kit	factory option	N/A	N/A
864309 (short) Exhaust Elbow Only	0.00	0.00	N/A	N/A	N/A	standard	N/A
864309 (short) Elbow + 1.70" Riser	1.70	1.70	N/A	N/A	N/A	kit	N/A
864309 (short) Elbow + 3.00" Riser	3.00	3.00	N/A	N/A	N/A	N/A	N/A
864309 (short) Elbow + 6.00" Riser	6.00	6.00	N/A	N/A	N/A	N/A	N/A

Exhaust Elbow Height

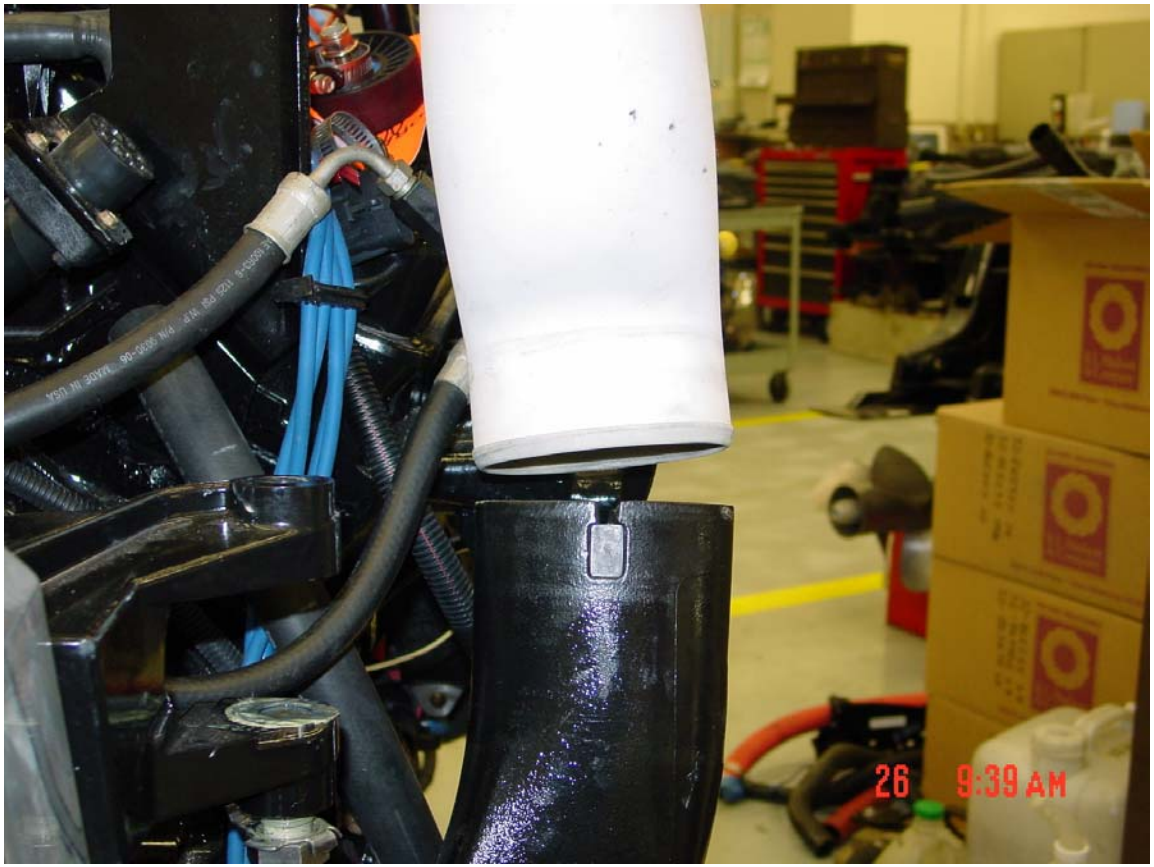


Turbulator will be removed from full flow gasket “New” PN 865786A01

Exhaust Elbow Height Intermediate Pipes

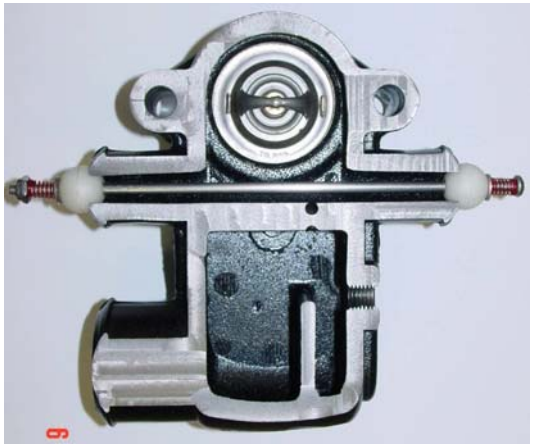
New intermediate pipes will be labeled with model, riser size and pn.
Improved alignment with bullhorn

Exhaust Elbow Height Intermediate Pipes



Exhaust Elbow Height

- System Overview
  - Flow control valve installed on thermostat housing for RWC 350 MAG & MX 6.2 MCM & MIE
    - Balances water flow between banks



Exhaust Elbow Height

- New Service Kit's
  - 1.7 inch riser's
    - 865995A01 RWC Warm Riser
    - 865996A01 FWC Warm Riser
    - 866007A01 RWC Tow Sports Warm Riser
  - Supplementary hose's
    - 865022A01 V6 MPI RWC 6" riser
    - 865998A01 V6 MPI FWC 6" riser

Exhaust Elbow Height

- New Service Kit’s
  - Intermediate Elbow Kit’s (2 elbows per kit)
    - 866000A01 V6 1.7” riser
    - 866001A01 V6 3” riser
    - 866002A01 V6 6” riser
    - 866003A01 SB V8 1.7” riser
    - 866004A01 SB V8 3” riser
    - 866005A01 SB V8 6” riser

Exhaust Elbow Height

- Service Kit's
  - Several existing kits will be impacted
    - CC for MPI & Carb
    - 3 & 6 inch riser
    - Long block

MERCURY
MerCruiser

4

2005
Product Update

Section 4

Transom Assemblies

Table of Contents

Quick Connects

- Gear Lube Bottle Relocation
- Oil Reservoir Hose
- Power Trim Hoses
- Power Steering Hoses
- Bravo Transom Water Hose
- Speedometer Hose
- MerCathode Assembly

Power Trim Pump Fuse Change

New Trim Pump Harness

Control Harness to Trim Pump Adaptor Harness

Trim Pump Reservoir Cap Change

Oil Bottle Float Change

New Rear Engine Mount Design (Quick Mounts)

Shift Plate Assembly Redesign

Intermediate Shift Cable Redesign

Transom Plate Assembly Components

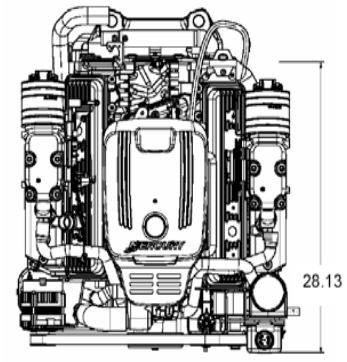
Quick Connects

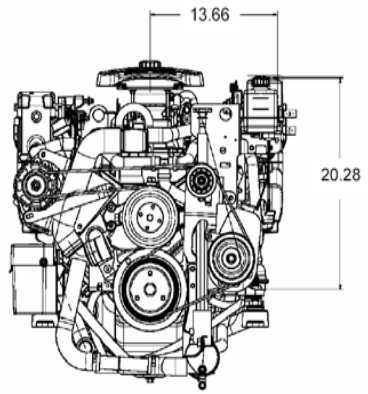
Added For Reduced Installation Time

and Secure Connections

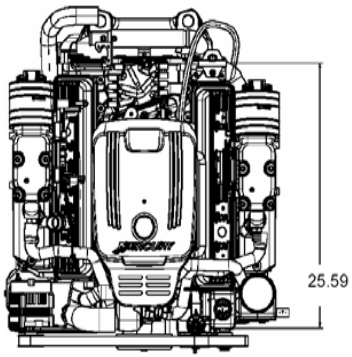
Gear Lube Bottle Relocation

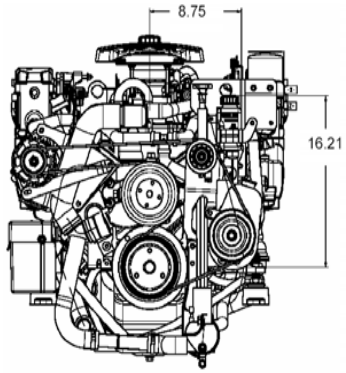
Previous Design





Released Design





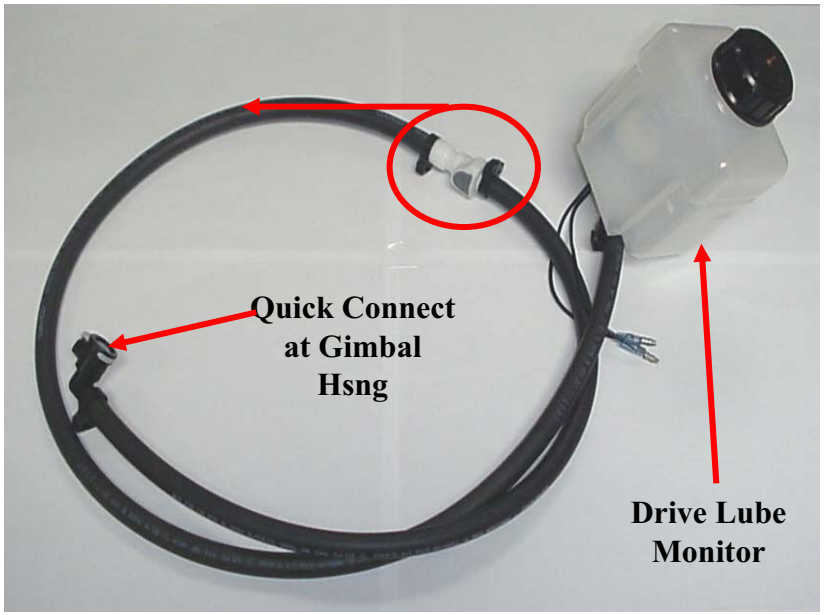
Inline Quick Connect

- **Project Definition**
  - Relocate gear lube bottle to eliminate interferences
  - Add inline quick connection to lube line
- **Benefits**
  - Eliminate improper connection between hose and gimbal housing due to space limitations
  - Reduce installation time
  - SN 0M640000 and up
- **Start of Production**
  - March 10, 2003 - completed

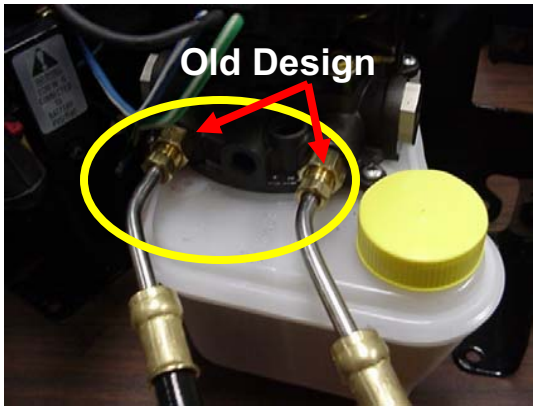
New Oil Reservoir Quick Connects

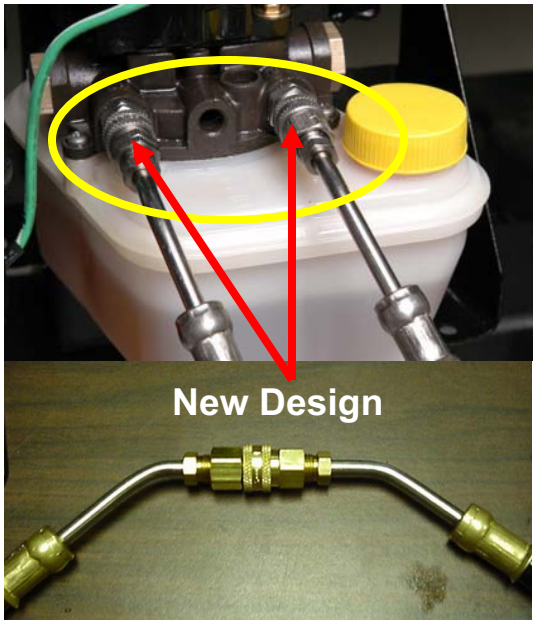
There is a new quick connect fitting between the oil reservoir bottle and the current 90 degree quick connect fitting at the transom for easier removal and installation of the bottle for cleaning and or engine removal

• 3/10/03 started with serial numbers 0M640000.



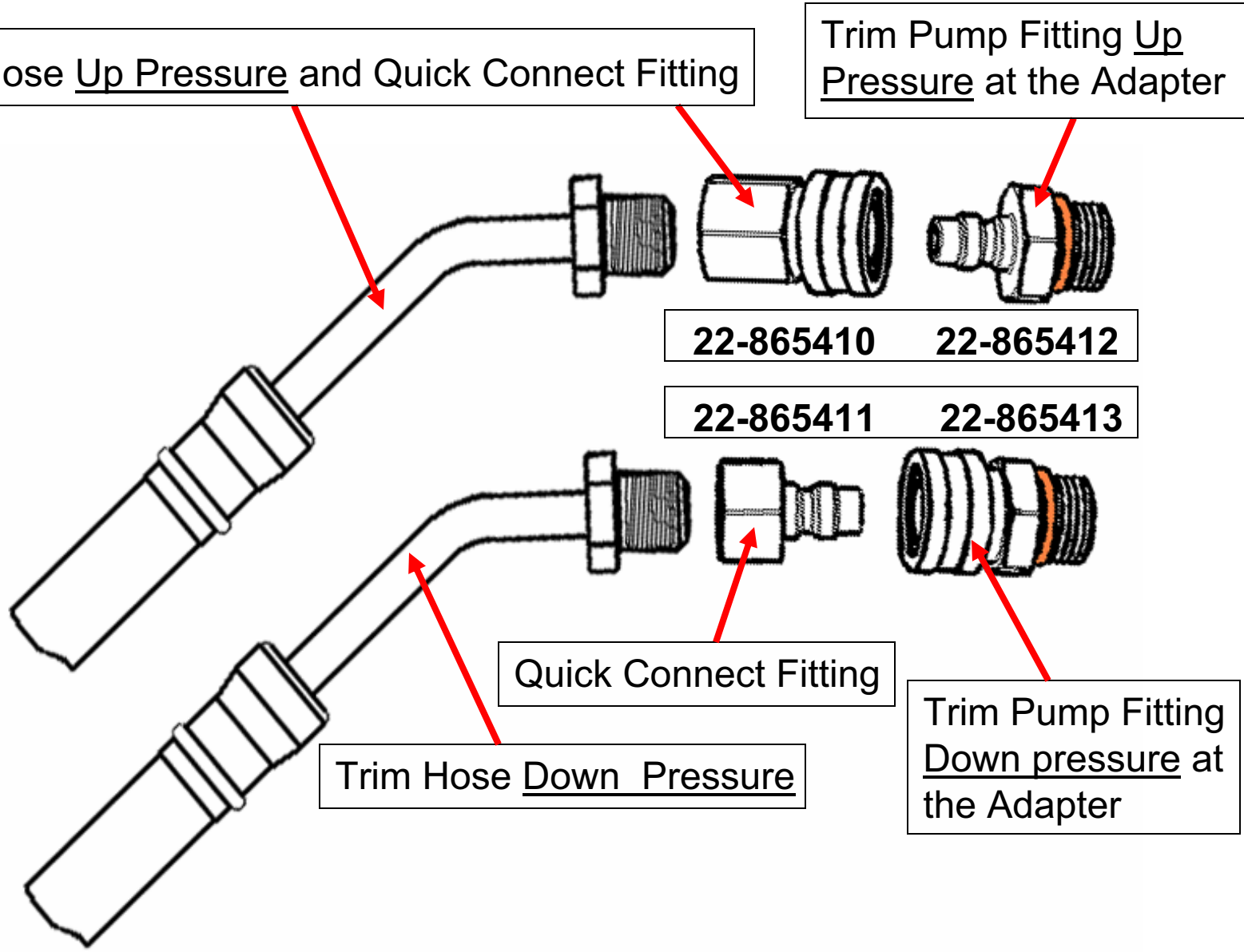
Drive Initiatives – January 2004
Power Trim Quick Connects





- **Project**
  - Hydraulic quick connect fittings
  - Brass Construction – brass components shown in picture
  - In March 2004 the Male fittings on both the trim pump adapter and the trim line from the transom will change from brass to stainless steel
  - Affects Alpha and Bravo Drives
- **Benefits**
  - Male / Female connections to insure correct connections
- **Impact**
  - SOP – January 12, 2004
  - Hydraulic lines will be connected - no plugs to remove
  - Single hand installation

Power Trim Quick Connects


Trim Hose Up Pressure and Quick Connect Fitting
Trim Pump Fitting Up Pressure at the Adapter
22-865410 22-865412
22-865411 22-865413
Quick Connect Fitting
Trim Hose Down Pressure
Trim Pump Fitting Down pressure at the Adapter

January 2004 Enhancements

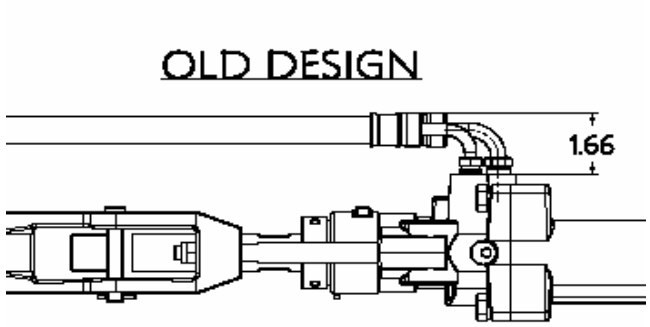
- Power steering hose quick-connect fittings
  - Reduce installation time and opportunity for leaks
    - All Sterndrive models with power steering

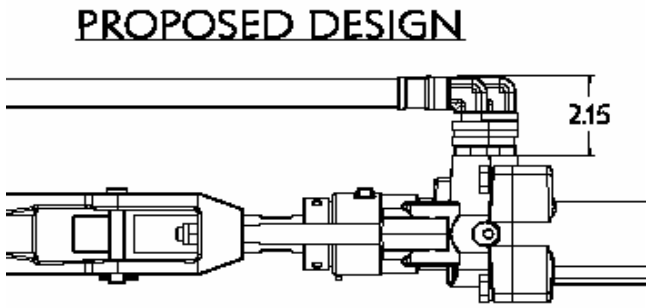
Current Production

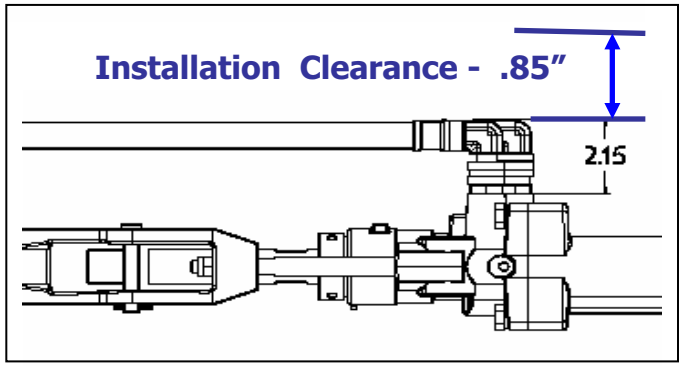
New Design

MERCURY MerCruiser

Drive Initiatives – January 2004
Power Steering Quick Connects

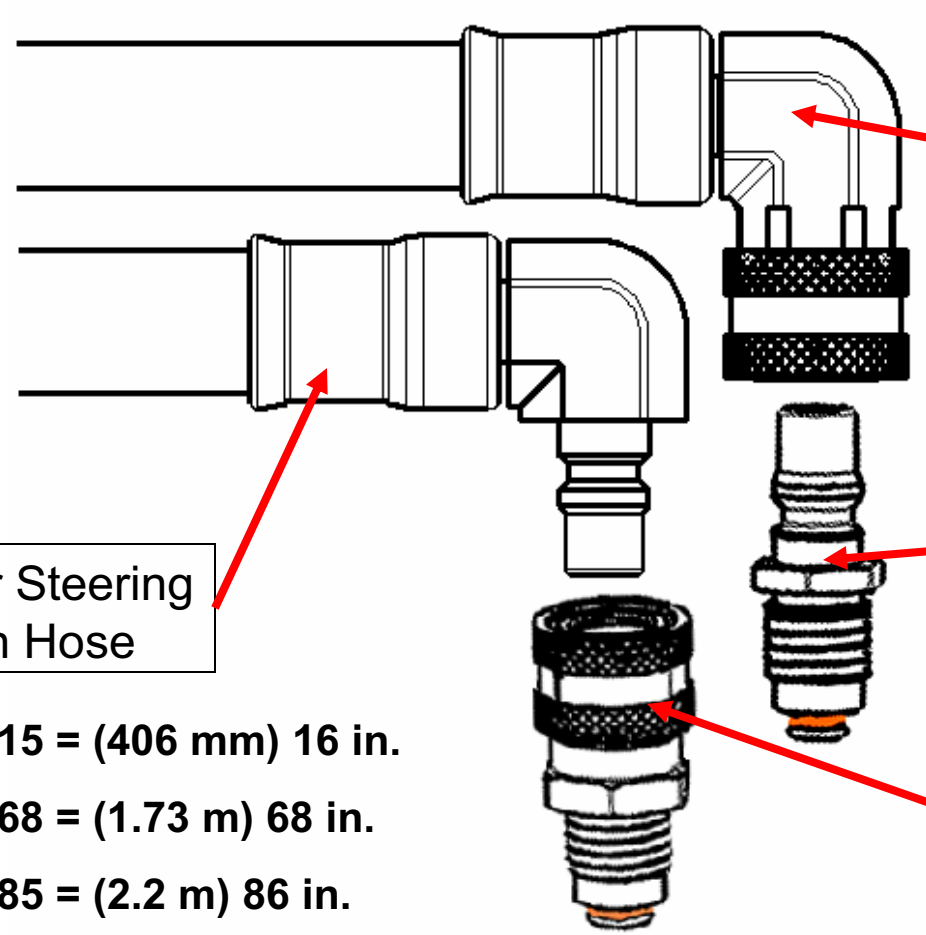






- **Project Definition**
  - Quick connect fittings
  - Nickel Plated Brass Construction
  - Affects Alpha and Bravo Drives
- **Benefits**
  - Eliminate cross threading on power steering cylinder
  - Reduce installation time
  - Male / Female connections to insure correct connections
- **OEM Impact**
  - Overall fitting height is 0.5" taller, requires .85 installation clearance
  - Hydraulic lines will be connected - no plastic coupler
  - Single hand installation
  - SOP – January 5, 2004

Power Steering Quick Connects



Power Steering High Pressure Hose

32-865387-053 = (1.3 m) 53in.

32-865387-060 = (1.5 m) 60 in.

Power Steering Valve Inlet Fitting

22-865414

Power Steering Valve Outlet Fitting

22-865415

Power Steering Return Hose

32-865390-015 = (406 mm) 16 in.

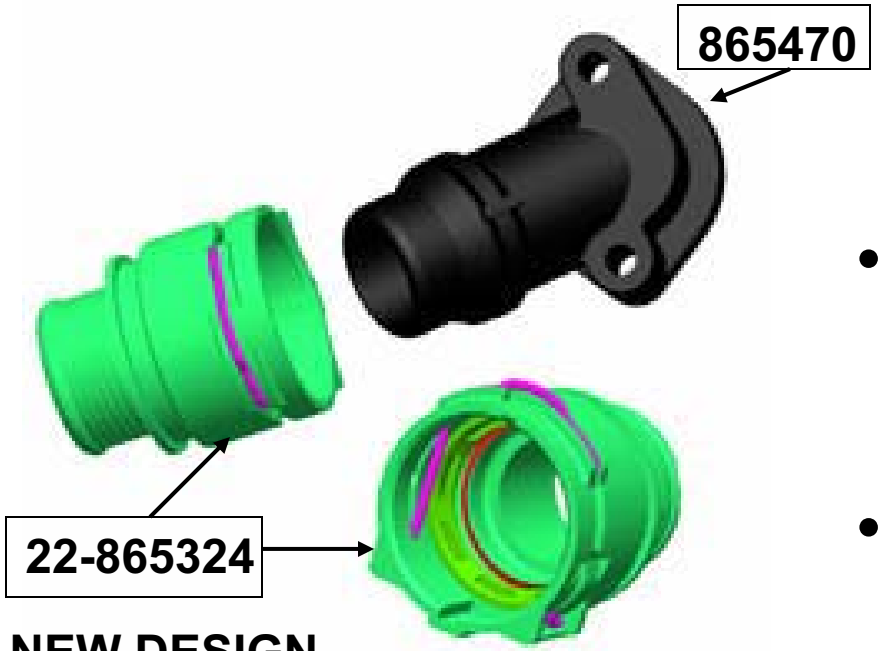
32-865390-068 = (1.73 m) 68 in.

32-865390-085 = (2.2 m) 86 in.

32-865390-134 = (3.4 m) 135 in.

Drive Initiatives – January 2004
Transom Water Hose Fitting

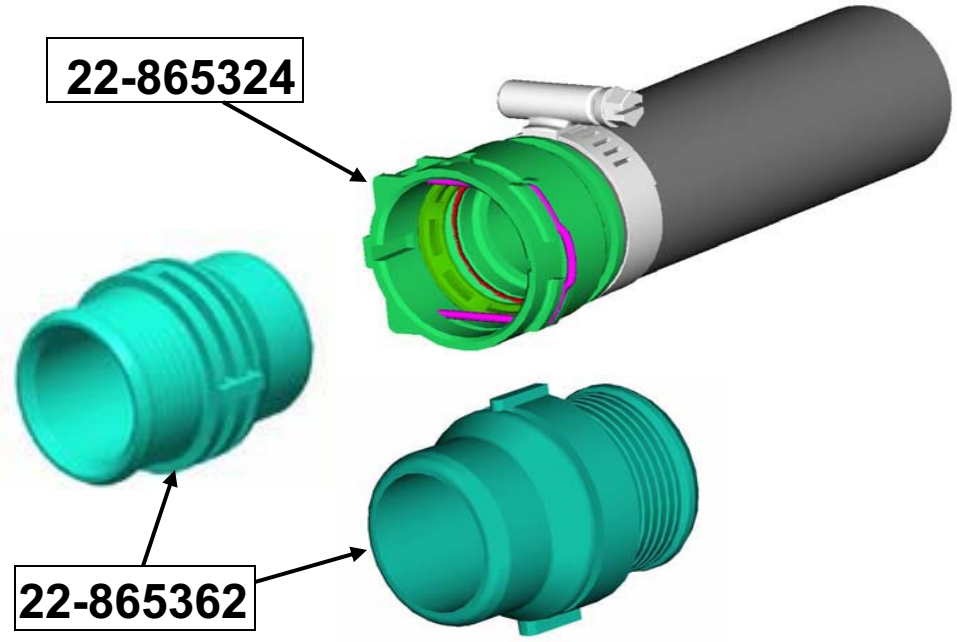
OLD DESIGN



NEW DESIGN

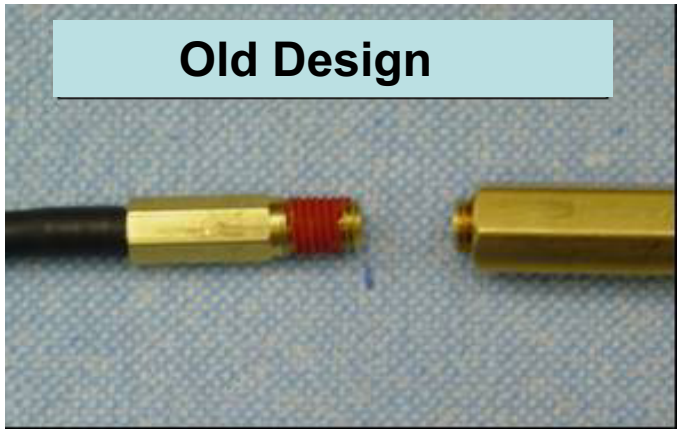
- **Project**
  - Redesign the inlet water fitting located on the transom.
  - Add quick connect fitting to inlet water hose
  - Minimize flow restriction through fitting.
  - Affects Bravo Drives Only
- **Benefits**
  - Reduce installation time at
  - Improved water flow through fitting
- **Impact**
  - SOP – January 8th, 2004

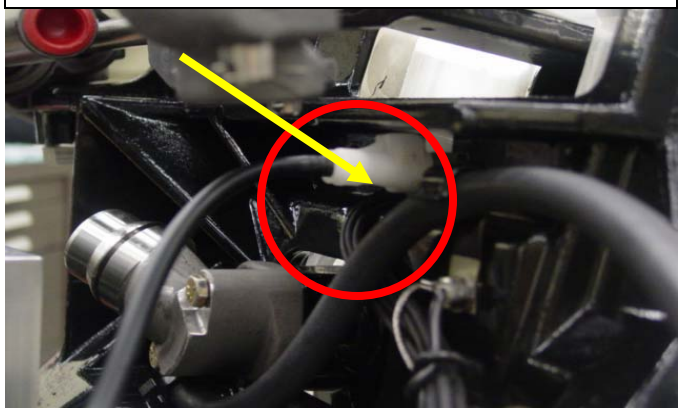
Drive Initiatives – January 2004
Sea Pump Water Hose Quick Connect



- **Project**
  - Provide easier installation for inlet hose via a quick connect junction in between transom and sea pump
  - Affects Bravo Drives Only
- **Benefits**
  - Eliminates difficulty associated with removal of hose from inlet of sea pump
- **Impact**
  - SOP – January 9th, 2004

Speedometer Quick Connect June 2003





- **Project Definition**
  - Quick connect fitting
  - Nickel Plated Brass / Plastic Construction
  - Affects Alpha and Bravo Drives
- **Benefits**
  - Male connector factory installed on gimbal housing – sealed when disconnected
  - SmartCraft steering / speedo kit will incorporate same fittings
- **OEM Impact**
  - Female connector included in parts bag
  - SOP – June 16, 2003
  - Single hand / blind installation

MerCathode Assembly

Previous Design

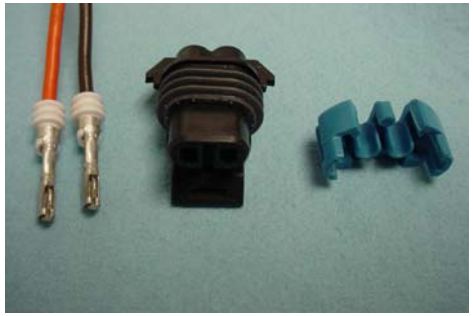
Released Design

- **Project Definition**
  - Add sealed connector in MerCathode harness to reduce installation time
  - Improve aesthetics on product
  - SN 0M640000 and up (Bravo Applications)
  - Launched in conjunction with gear lube relocation and quick connect changes
- **Start of Production**
  - March 10, 2003 completed

New MerCathode Quick Connect Feature

MerCathode Quick Connects

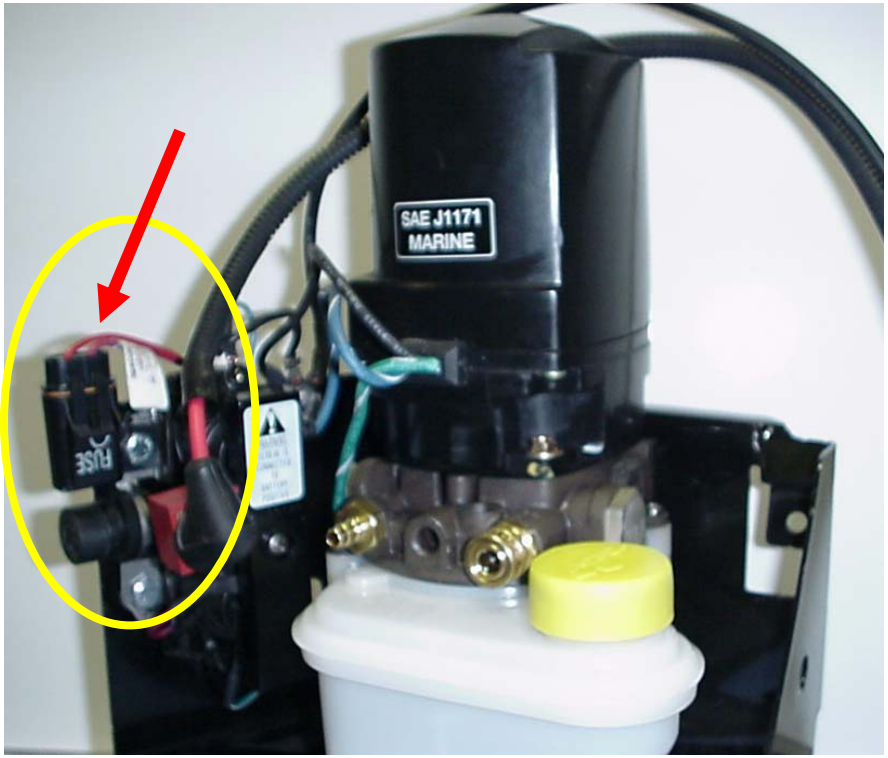
The service replacement MerCathode unit will come with the connector disassembled for ease in replacement through the hydraulic manifold



New Quick Connect Design

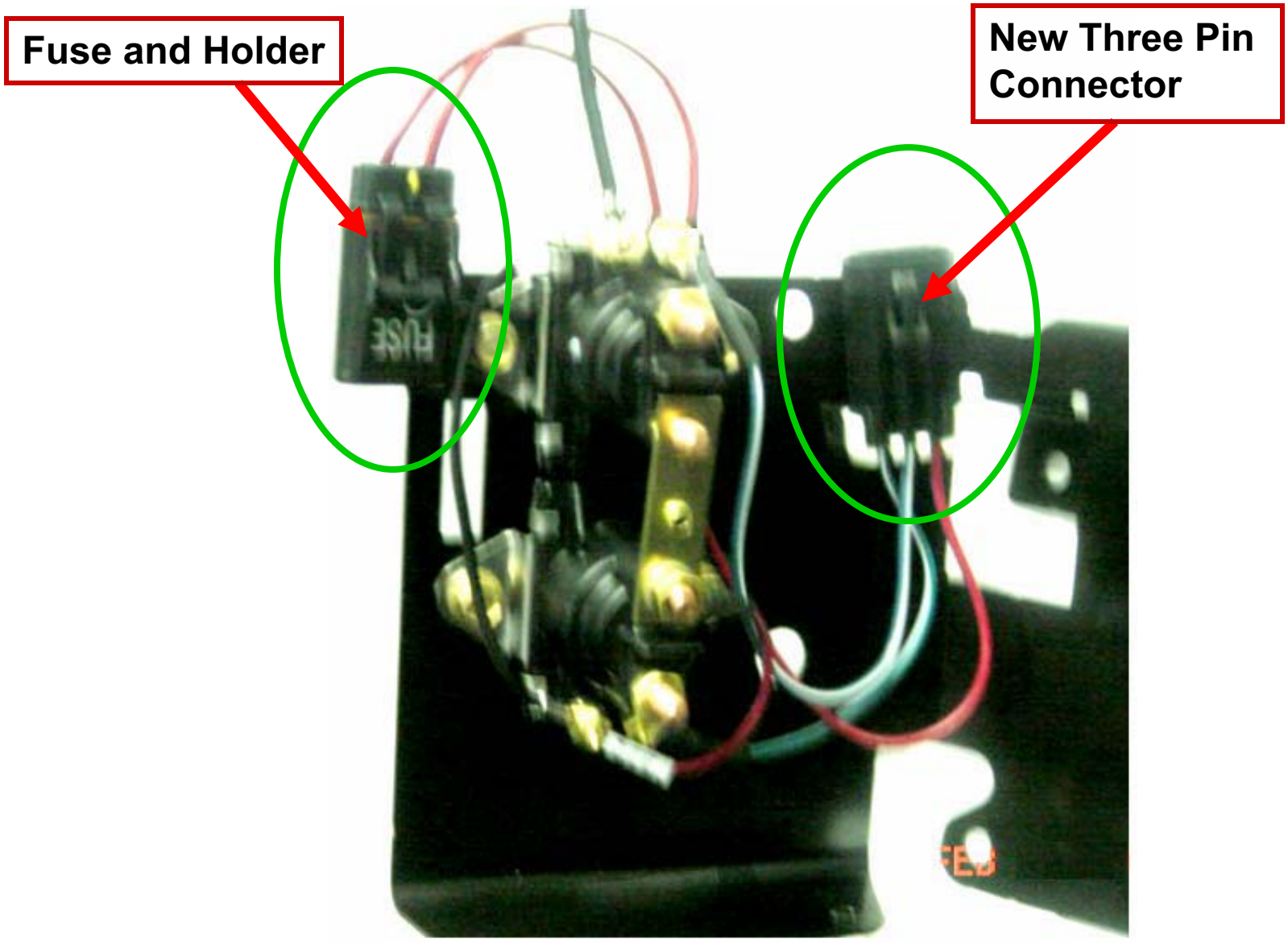
Old Design

Drive Initiatives – January 2004
Fuse change – Trim Pump



- **Project**
  - Replace glass fuse assembly with flat blade style fuse
- **Benefits**
  - Eliminate damage to fuse during disassembly of fuse holder
  - Automotive style fuse
- **Impact**
  - SOP – January 12, 2004

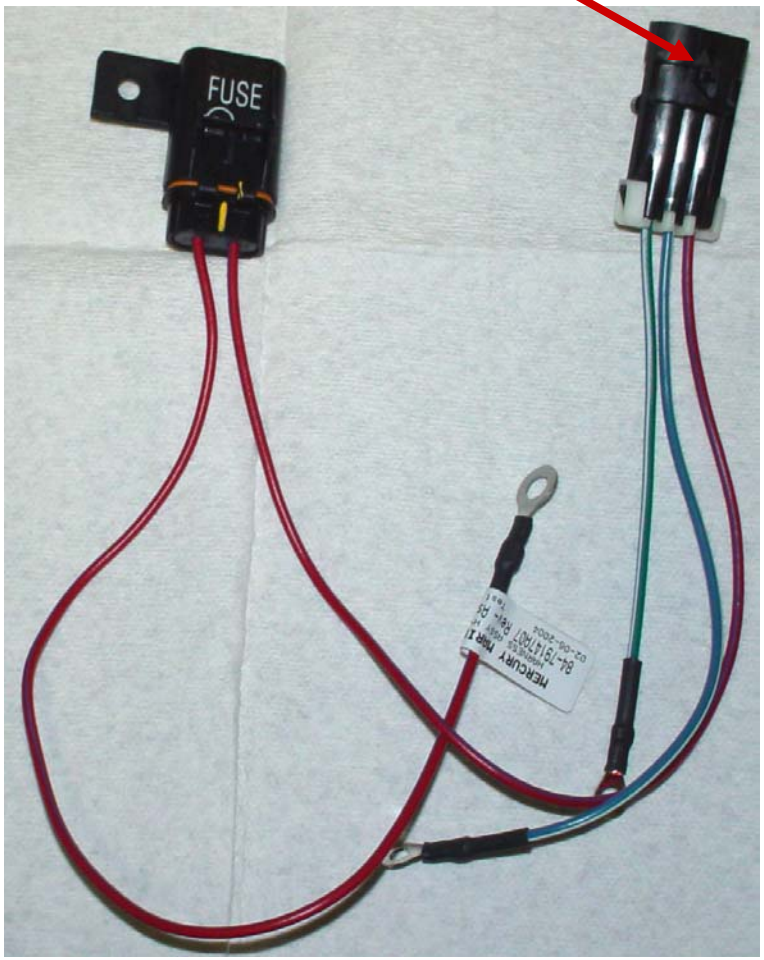
New Trim Pump Harness

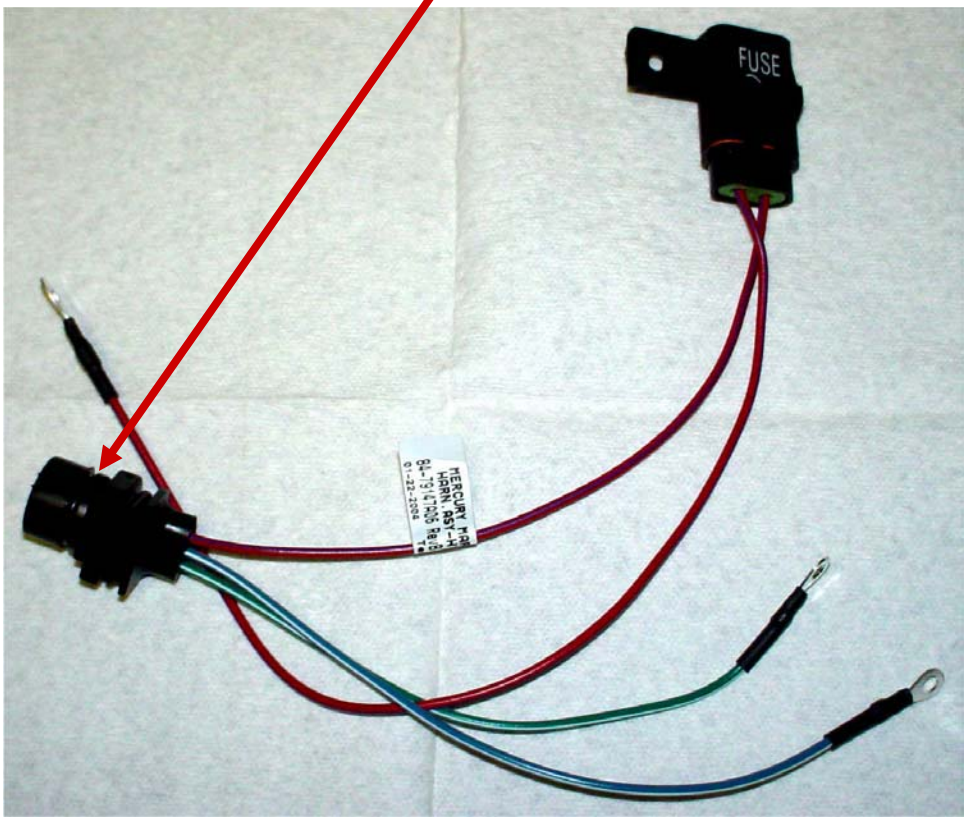


New and Current Trim Pump Harness

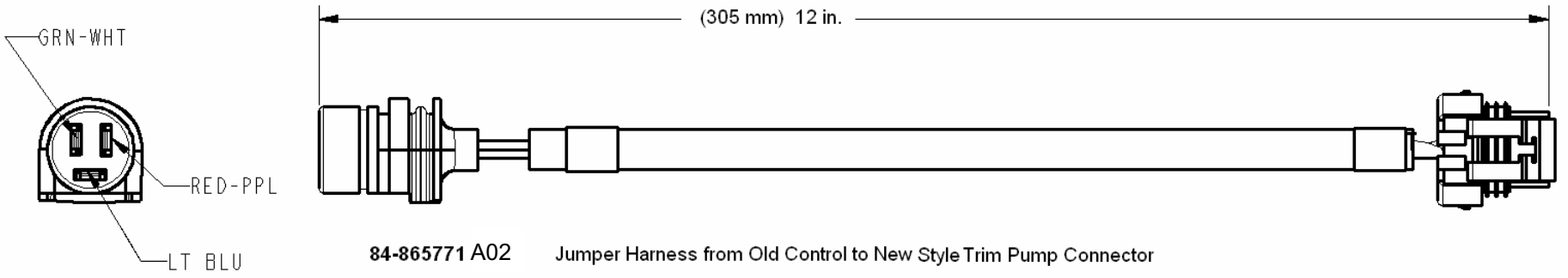
New Three Pin Packard Connector

Current Three Blade Round Connector

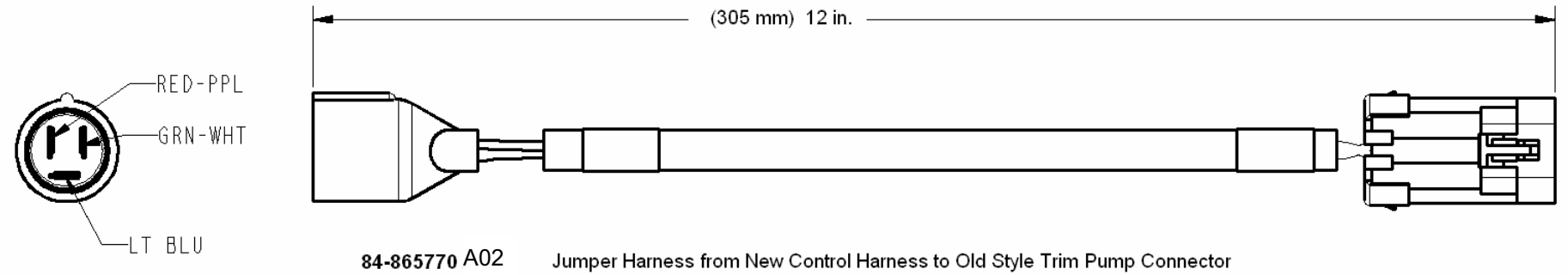




Control Harness to Trim Pump Adapter Harnesses

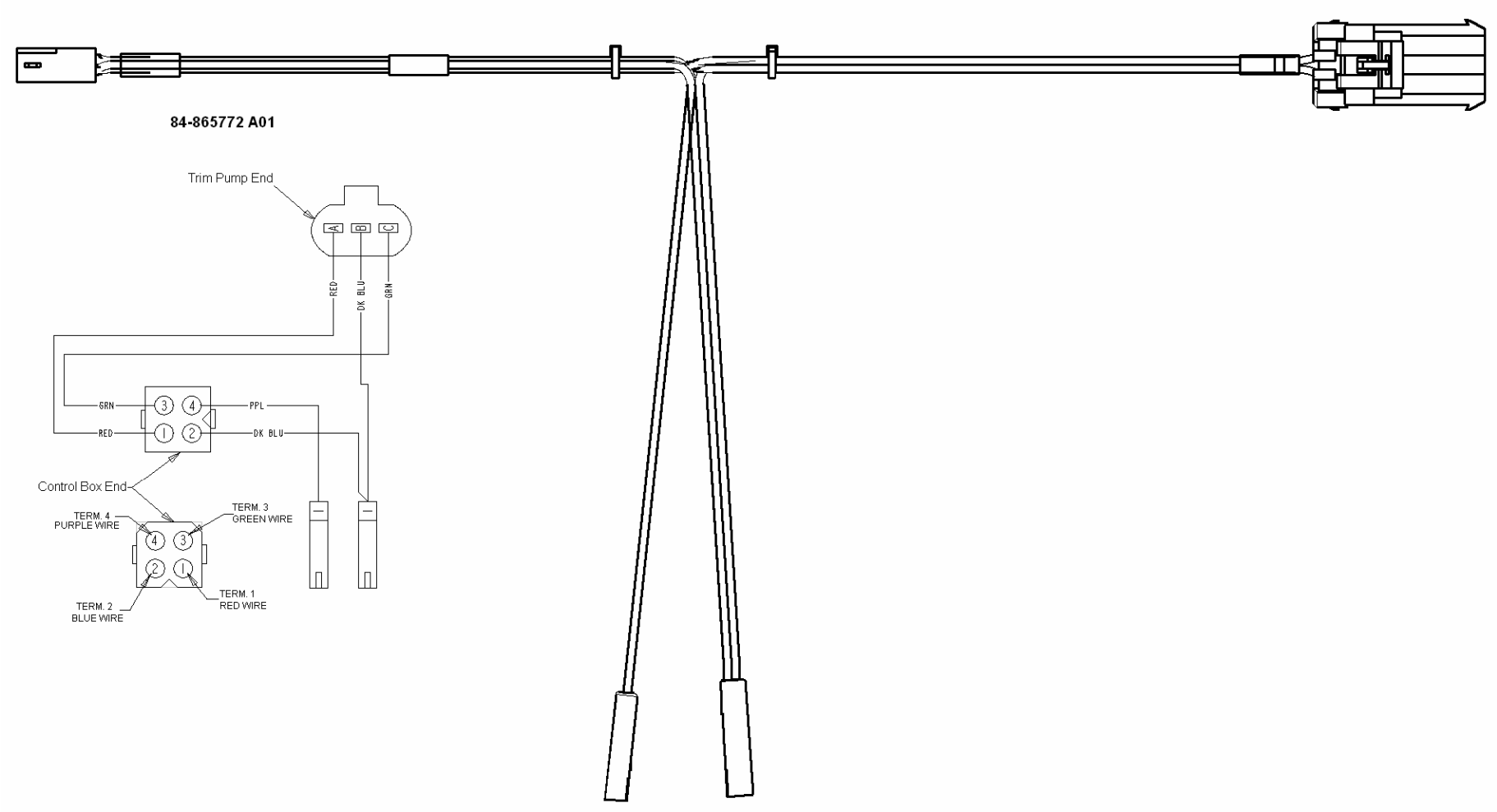


84-865771 A02 Jumper Harness from Old Control to New Style Trim Pump Connector

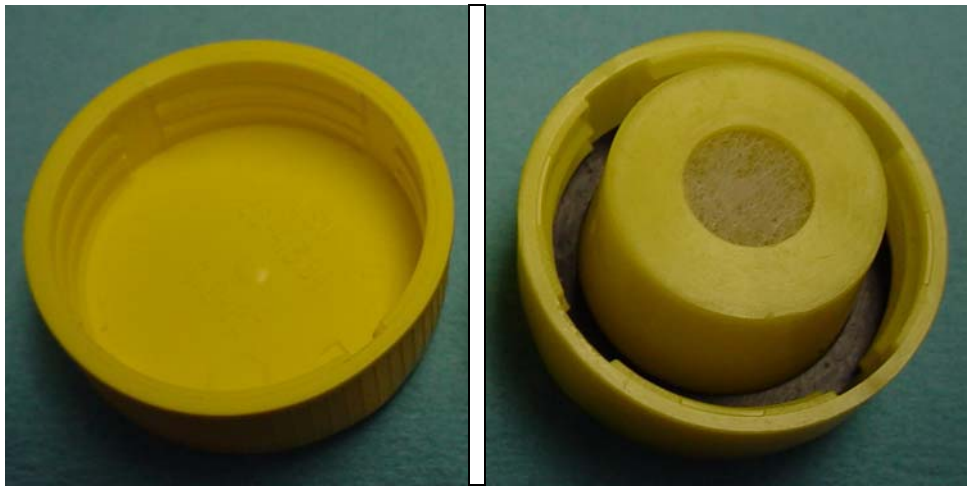


84-865770 A02 Jumper Harness from New Control Harness to Old Style Trim Pump Connector

Control Harness to Trim Pump Adapter Harness



Trim Pump Reservoir Cap Change



<u>Problem:</u> Trim Pump Cap Leaks

• Trim pump purges oil through side vents in rough water applications.

<u>Root Cause:</u>

• Cap vents are large enough to allow sloshing oil to pass from reservoir to the exterior.

<u>Solution:</u>

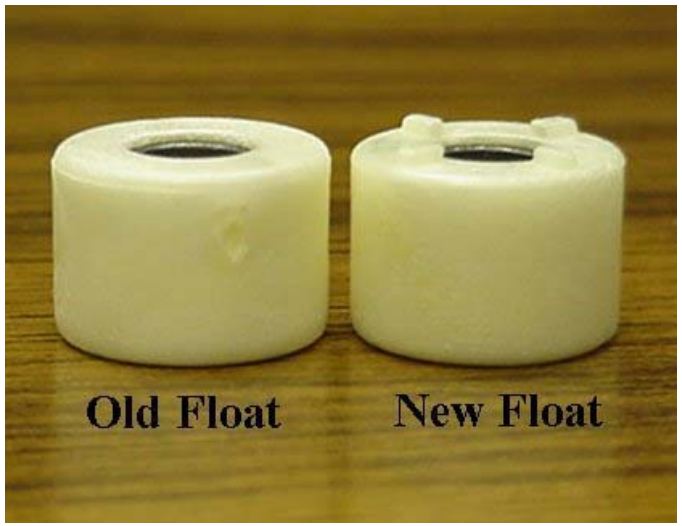
• Provide a baffle in cap which allows air to vent but reduce the ability for liquid to migrate. New cap has a (yellow colored baffle and a rubber seal gasket) installed.

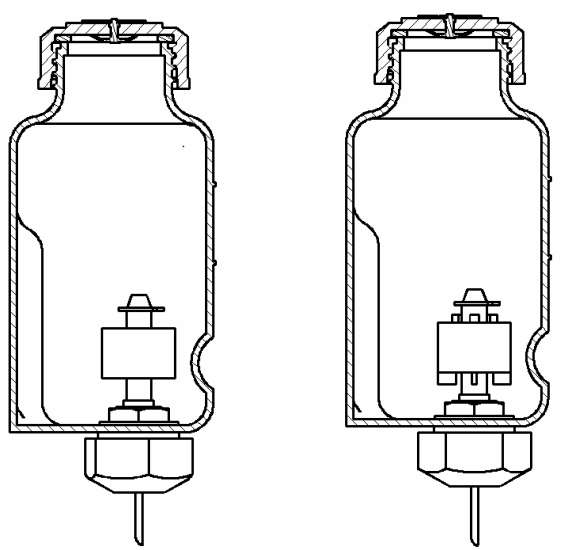
<u>Current Status:</u>

•Tested in Placida and passed with no leakage

•New design went in to production starting with serial number 0M680000

Oil Bottle Float Change





The float in the oil reservoir bottle was improved to prevent it from sealing off the outlet when the bottle is filled from the top, causing the audio warning to sound even though the bottle was filled
The new float went into production on 5/19/03 Starting S/N 0M653864

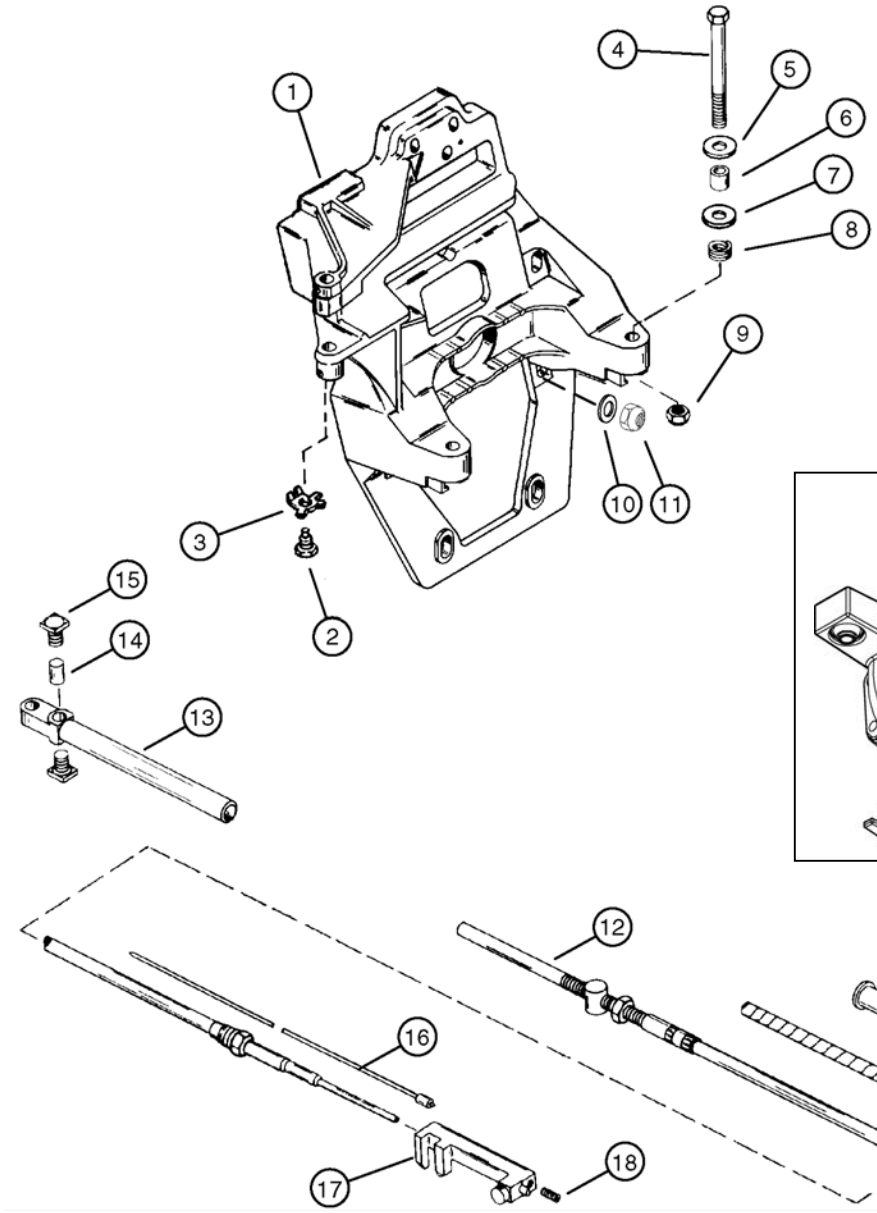
New Rear Engine Mount Design

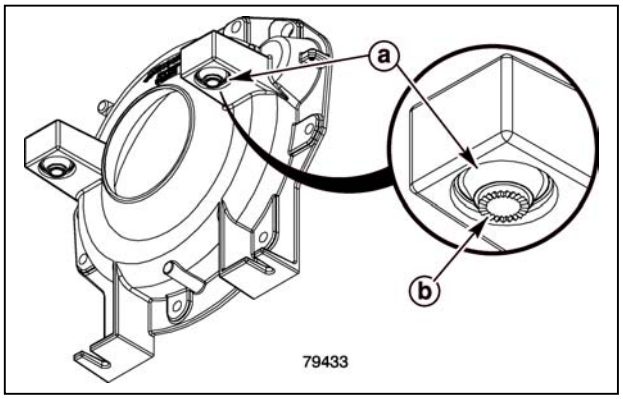
Alpha Shown - Bravo Similar

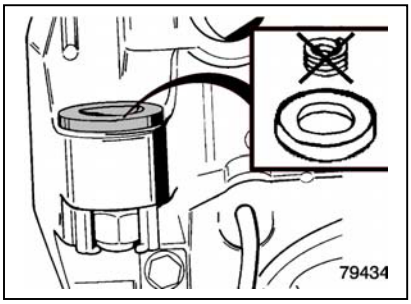
Note: *New engines use a modified rear engine mount system (a). The bottom of the rear mount now has a knurled edge (b) [older version was smooth].*

The "double-wound" lockwasher (spring) is no longer used.

The large fiber washer is still used.



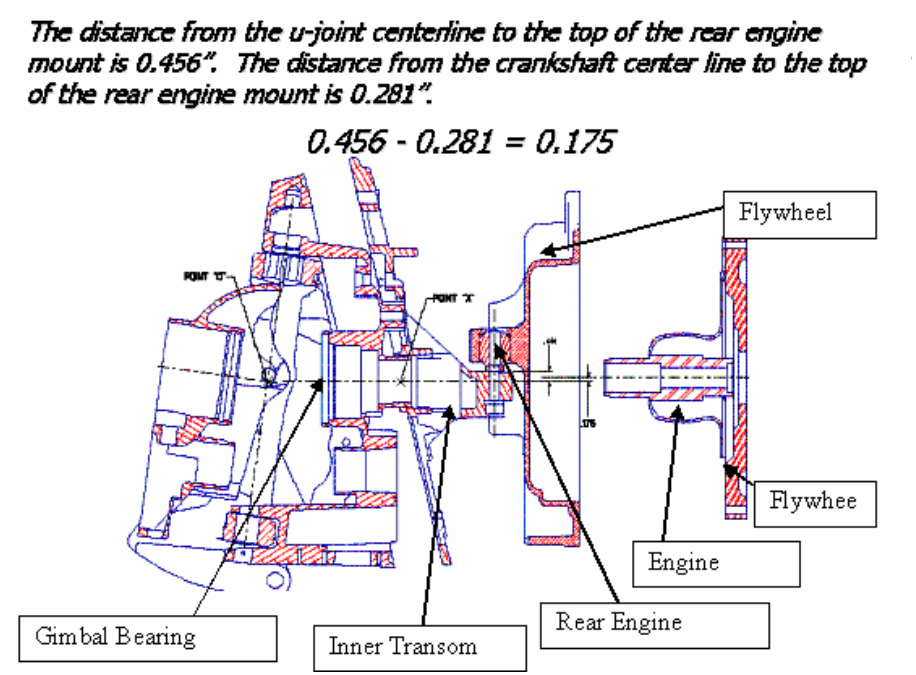




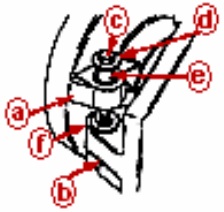
1 - Transom Plate Assembly
2 - Pivot Bolts
3 - Tab Washers
4 - Screw Engine Mounting
5 - Washer
6 - Spacer
7 - Washer - Fiber
8 - Lockwasher - Double Wound
9 - Locknut
10- Washer
11- Locknut
12- Shift Cable Outer Casing
13- End Guide
14- Core Wire Anchor
15- Anchor Screws
16- Core Wire
17- Shift Slide
18- Screw - Core Wire Cavity
19- Gimbal Housing Eyelet
20- Cable Wrapping

NOTE: *Some OEM's have not yet made the final modifications to the boat stringers (front engine mounts are now lower). A .104 in. stainless steel washer is placed in the center of each fiber washer to slightly raise the engine when installed.*

Drive Changes – June 2003
Improved Engine Alignment


The distance from the u-joint centerline to the top of the rear engine mount is 0.456". The distance from the crankshaft center line to the top of the rear engine mount is 0.281".
0.456 - 0.281 = 0.175
Flywheel
Flywhee
Engine
Rear Engine
Inner Transom
Gimbal Bearing

New Rear Engine Mount Design



a - Rear Engine Mount
b - Inner Transom Plate Mount
c - Bolt
d - Washer
e - Spacer
f - Fiber Washer

Project Definition

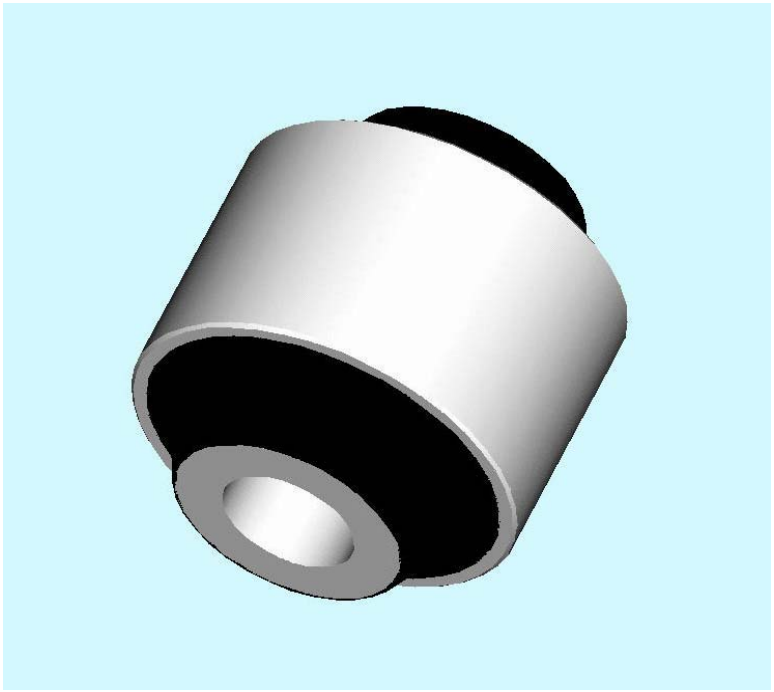
- Address offset at nominal (detected by stack-up) at the rear engine mount / inner transom plate interface – additional material to be added to rear engine mounts
- Minimize future potential for misalignment due to component stack-up in the following areas:
  - Rear engine mounts / inner transom plate interface
  - Engine coupler position / flywheel interface
  - Engine coupler perpendicularity / flywheel interface
- Tied in with coupler improvements
- Affects Alpha and Bravo Drives

- **Benefits**
  - Eliminate misalignment (MerCruiser product) at the Dealer & OEM.

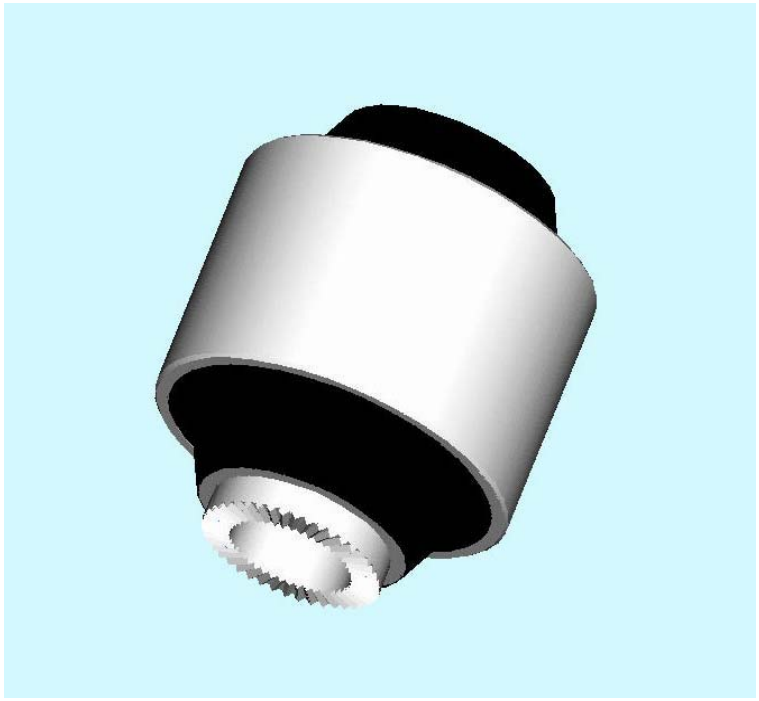
Eliminates double-wound lock washer

- SOP – June 17, 2003

Old and New Style Mounts

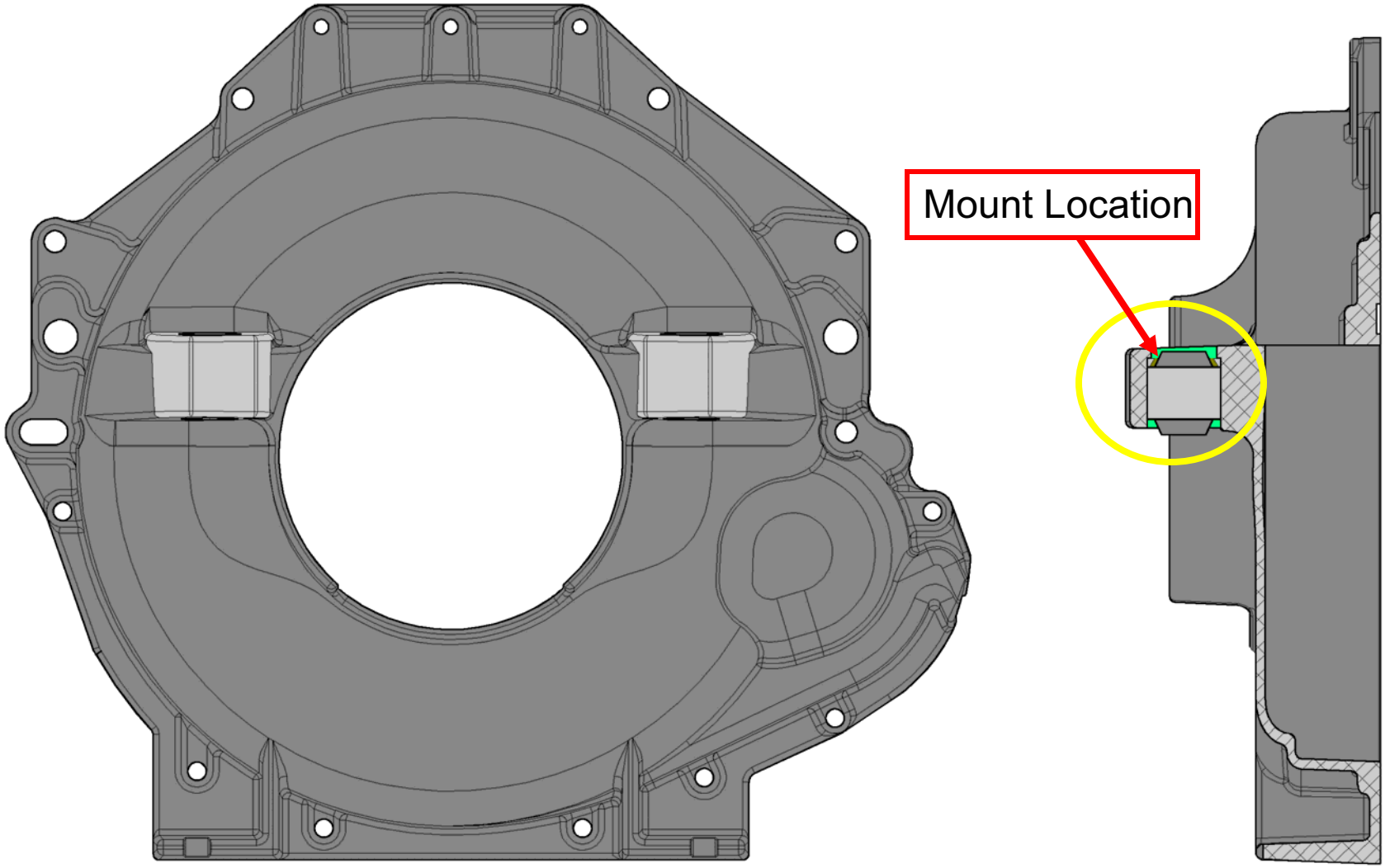


Old Engine Mount

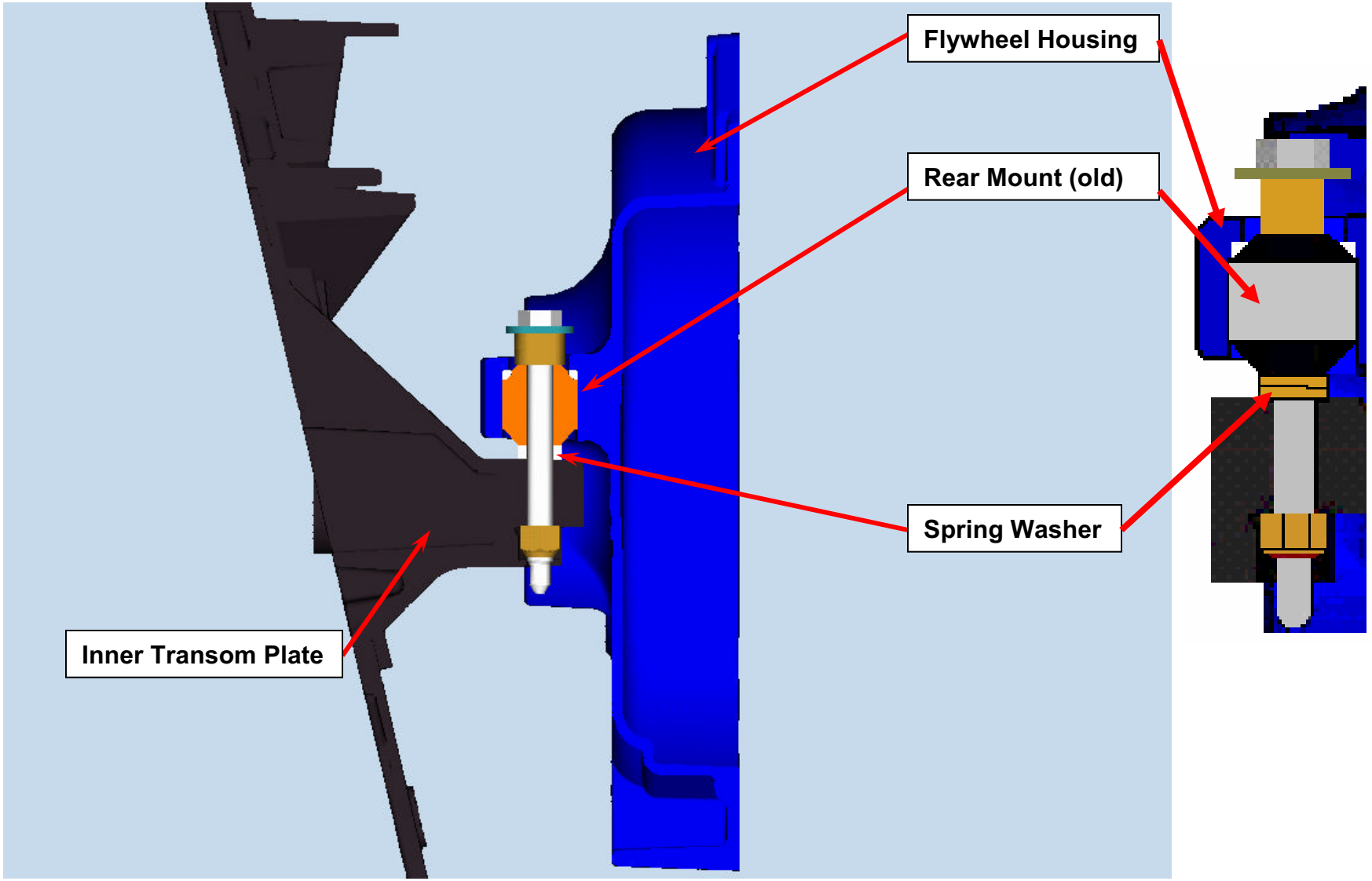


New Engine Mount

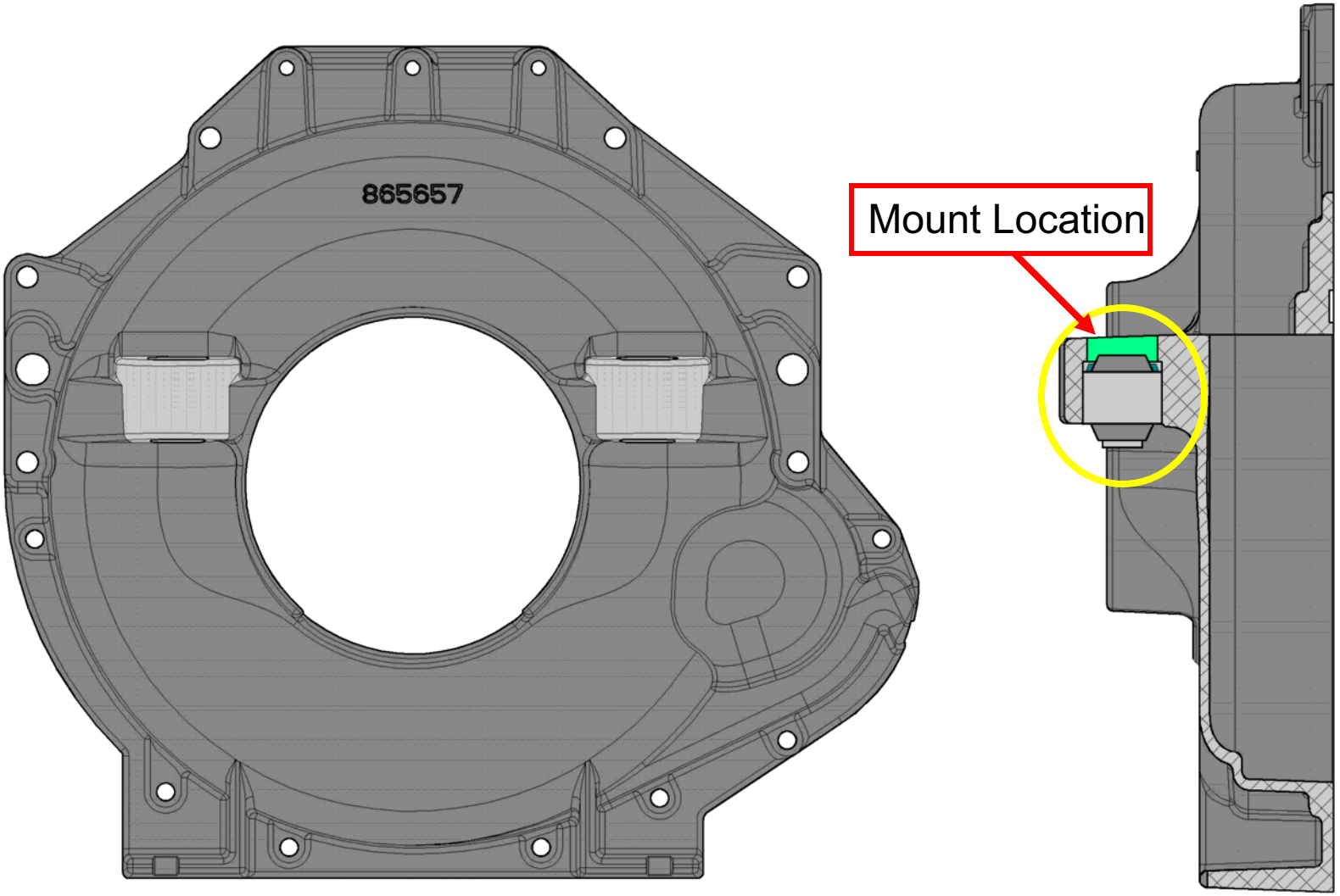
Old Design Flywheel Housing



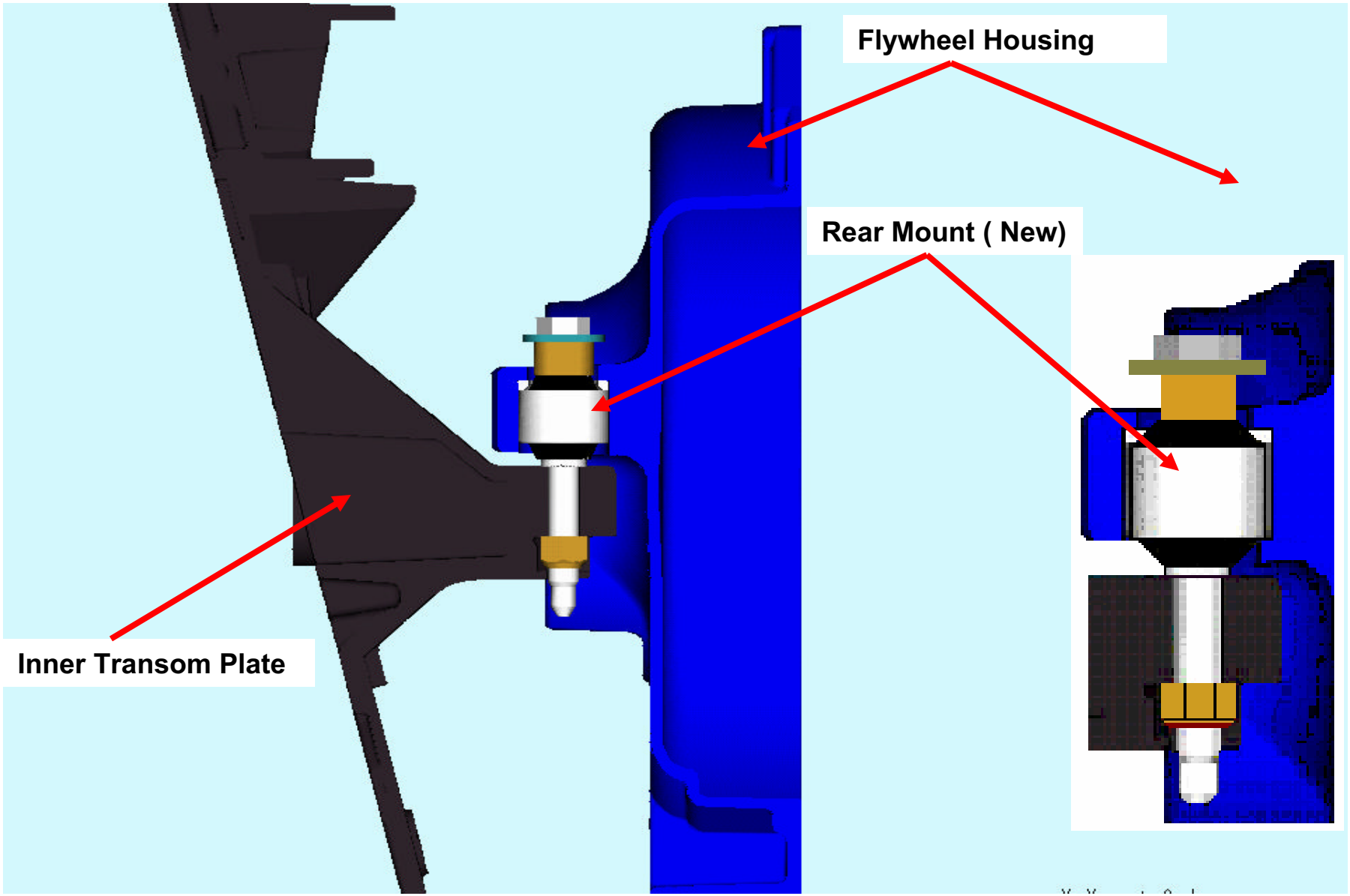
Old Style Rear Mount Installed



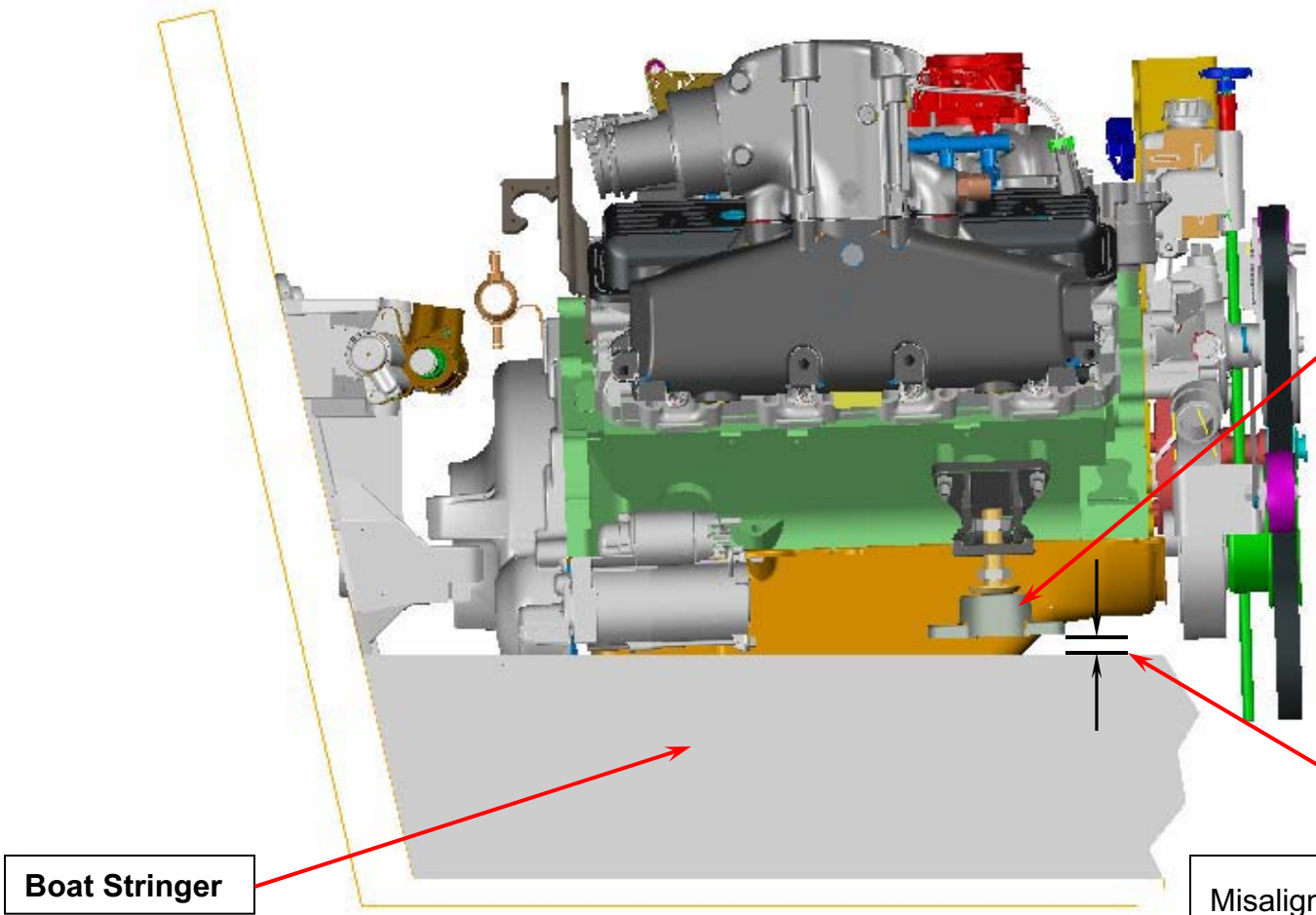
New Design Flywheel Housing



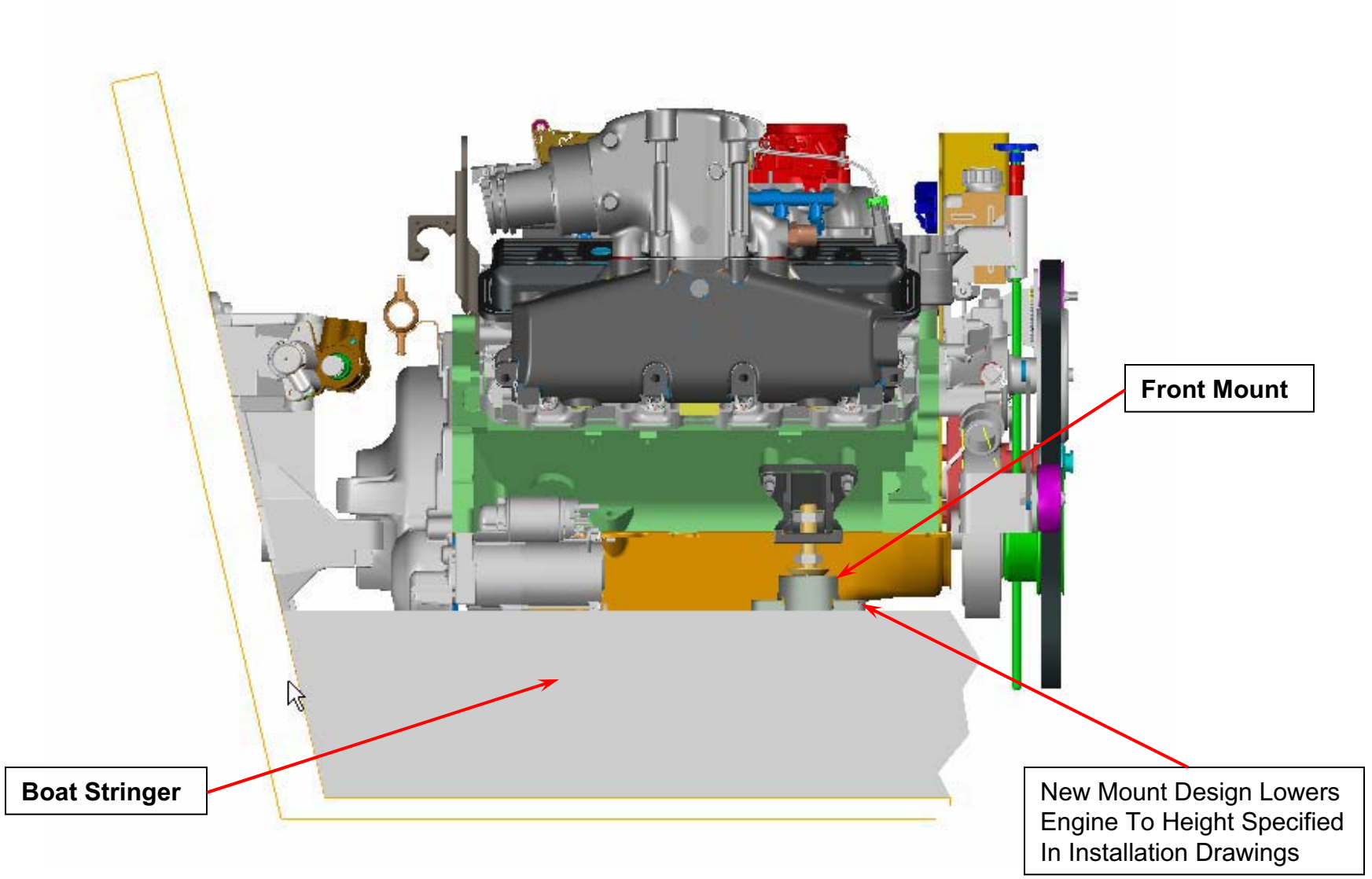
New Style Rear Mount Installed



Engine Placement When Using Old Style Rear Engine Mount



Engine Placement Using New Design Rear Engine Mount



MERCURY MerCruiser

Service Bulletin

☐ Warranty Information ☑ Service Information Bulletin No. 2003-11

☐ Parts Information OEM No. 2003-04

Circulate to: ☑ Sales Manager ☐ Accounting ☑ Service Manager ☑ Technician ☑ Parts Manager

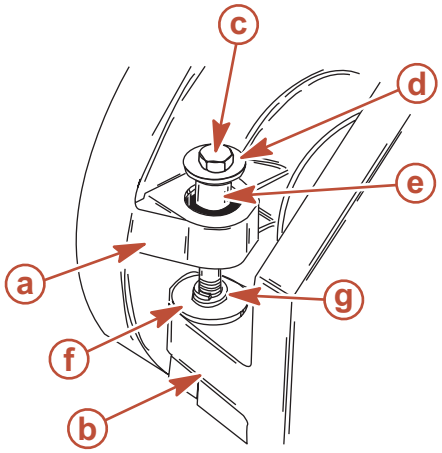
MCM Rear Engine Mount Design Change

Models Affected

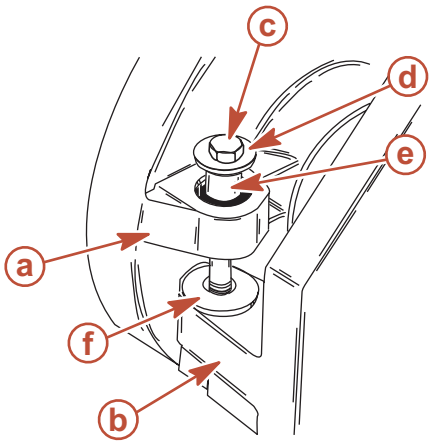
MCM 3.0L / MCM 4.3L / MCM 4.3 MPI/ MCM 5.0L / MCM 5.0 MPI / MCM 5.7L / MCM 350 MAG MPI / MCM 350 MAG MPI HORIZON / MCM MX6.2 MPI / MCM 6.2 MPI MAG HORIZON / MCM 496 MAG / 496 MAG HO

Situation

Starting with serial number 0M660000 and above, the rear engine mounts have been redesigned to improve engine alignment between the transom and the engine. With this design, the double wound lock washer has been removed and the flywheel housing engine mount has been adjusted to better align the engine coupler to the gimbal bearing.



Original design



New design

a - Rear engine mount
b - Inner transom plate
c - Bolt
d - Washer
e - Spacer
f - Fiber washer
g - Double-wound washer

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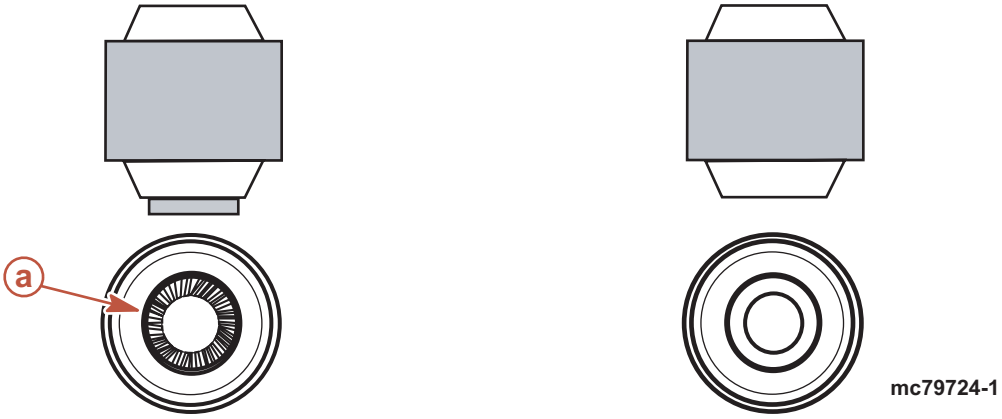
The new flywheel housing mount is serrated on the bottom side where it makes contact with the support mount ear on the inner transom plate assembly. The knurl will prevent mount windup when tightening the rear mount bolt to the nut in the inner transom plate.



New design Old design

a - Knurl

When MCM engines started shipping on 06/17/03, the rear engine mount was changed to the new design. When this new design started, the inner transom plate assembly had the double wound lock washers and the fiber washers removed as part of the new design. The fiber washers were later put back onto the inner plate to eliminate any possible type of engine flywheel housing contact with the inner transom plate mounting ear. When repowering a boat, the new replacement engine may require the addition of a Spacer Kit, P/N 12-892619A01 to be installed between the rear engine mount and the inner transom plate mounting ear. Each kit contains the parts required to shim one engine. Procedure shown following.

Installation

NOTE: *Ensure that the inner transom plate mount is clean and free of all adhesive and debris.*

1. Apply glue to the fiber washer and position it equally around the rear engine mount bolt hole on the inner transom plate mount.

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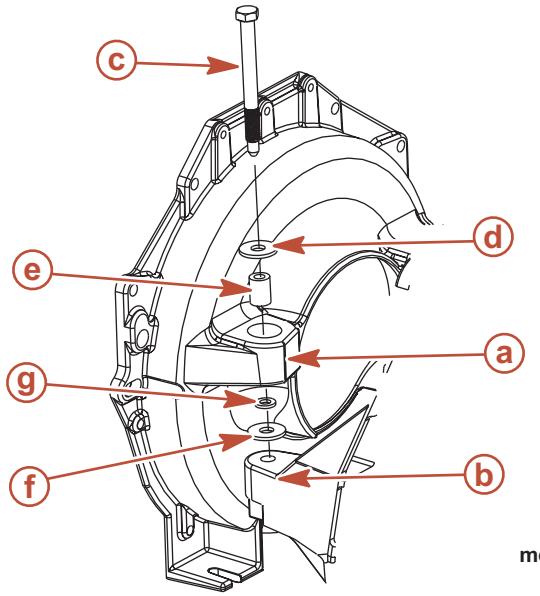
2. Place the stainless steel washer inside the fiber washer.



a - Rear engine mount
b - Inner transom plate mount
c - Bolt
d - Washer
e - Spacer
f - Fiber washer
g - Stainless steel washer

Tube Ref. No.	Description	Where Used	Part Number
162	Super Glue	Fiber washer	Obtain Locally

3. install engine into boat and align. Refer to appropriate Mercury MerCruiser engine service manual for engine alignment procedure.

The front engine mounts have a limited amount of adjustment. In some installations, there is not enough downward adjustment to achieve proper alignment with the front engine mount pads in the boat at their current position. This situation may also be encountered when replacing old flywheel housing with a new one. As a result of lowering the rear of the engine to the ideal position the front of the engine must be lowered even more to achieve proper engine to transom alignment. The chart below shows by model the nominal distance, measured at the front engine mount, that the front of the engine must be lower to achieve proper alignment.

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Nominal Drop At Front Mount Using New Rear Engine Mounts

Model	2.7 mm (0.106 in.) Spacer	Transom Thickness - 50.8 mm (2.00 in.)	Transom Thickness - 57.2 mm (2.25 in.)
3.0L Alpha with front pedestal mount	With	9.1 mm (0.358 in.)	8.8 mm (0.346 in.)
	Without	22.7 mm (0.894 in.)	22.1 mm (0.870 in.)
3.0L Alpha with side mounts	With	5.9 mm (0.232 in.)	5.8 mm (0.228 in)
	Without	14.8 mm (0.583 in.)	14.4 mm (0.567 in.)
4.3L Alpha/Bravo	With	5.9 mm (0.232 in.)	5.8 mm (0.228 in)
	Without	14.8 mm (0.583 in.)	14.4 mm (0.567 in.)
5.0L Alpha/Bravo	With	7.1 mm (0.280 in.)	6.9 mm (0.272 in.)
	Without	17.7 mm (0.697 in.)	17.1 mm (0.673 in.)
5.7L Alpha/Bravo	With	7.1 mm (0.280 in.)	6.9 mm (0.272 in.)
	Without	17.7 mm (0.697 in.)	17.1 mm (0.673 in.)
350 Mag Alpha/Bravo	With	7.1 mm (0.280 in.)	6.9 mm (0.272 in.)
	Without	17.7 mm (0.697 in.)	17.1 mm (0.673 in.)
MX6.2 MPI Bravo	With	7.1 mm (0.280 in.)	6.9 mm (0.272 in.)
	Without	17.7 mm (0.697 in.)	17.1 mm (0.673 in.)
496 Mag MPI Bravo (Base & H.O.)	With	7.1 mm (0.280 in.)	6.9 mm (0.272 in.)
	Without	17.7 mm (0.697 in.)	17.1 mm (0.673 in.)

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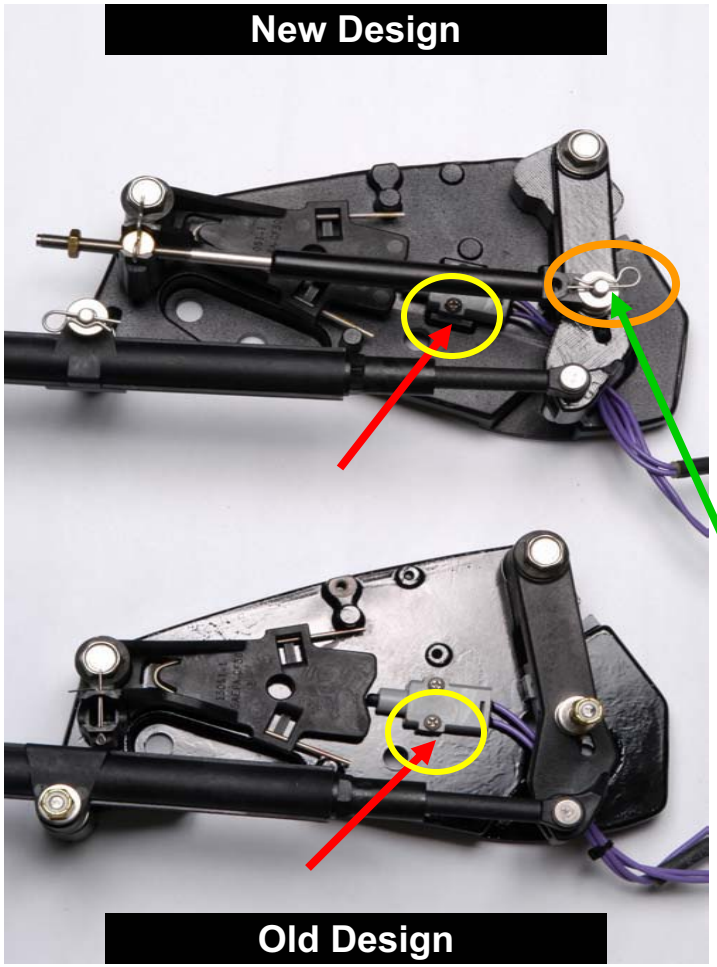
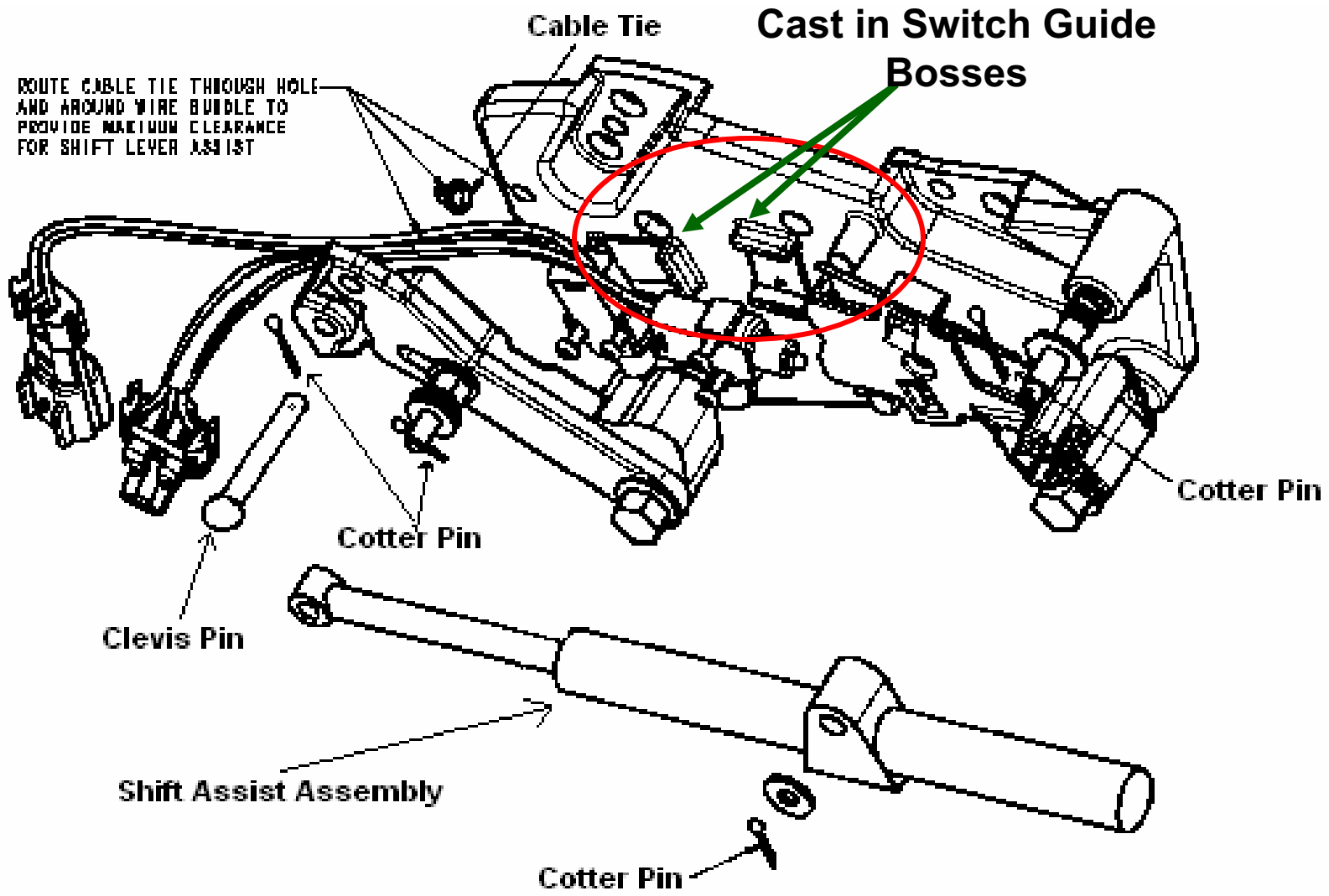
Shift Plate Assembly June 2003

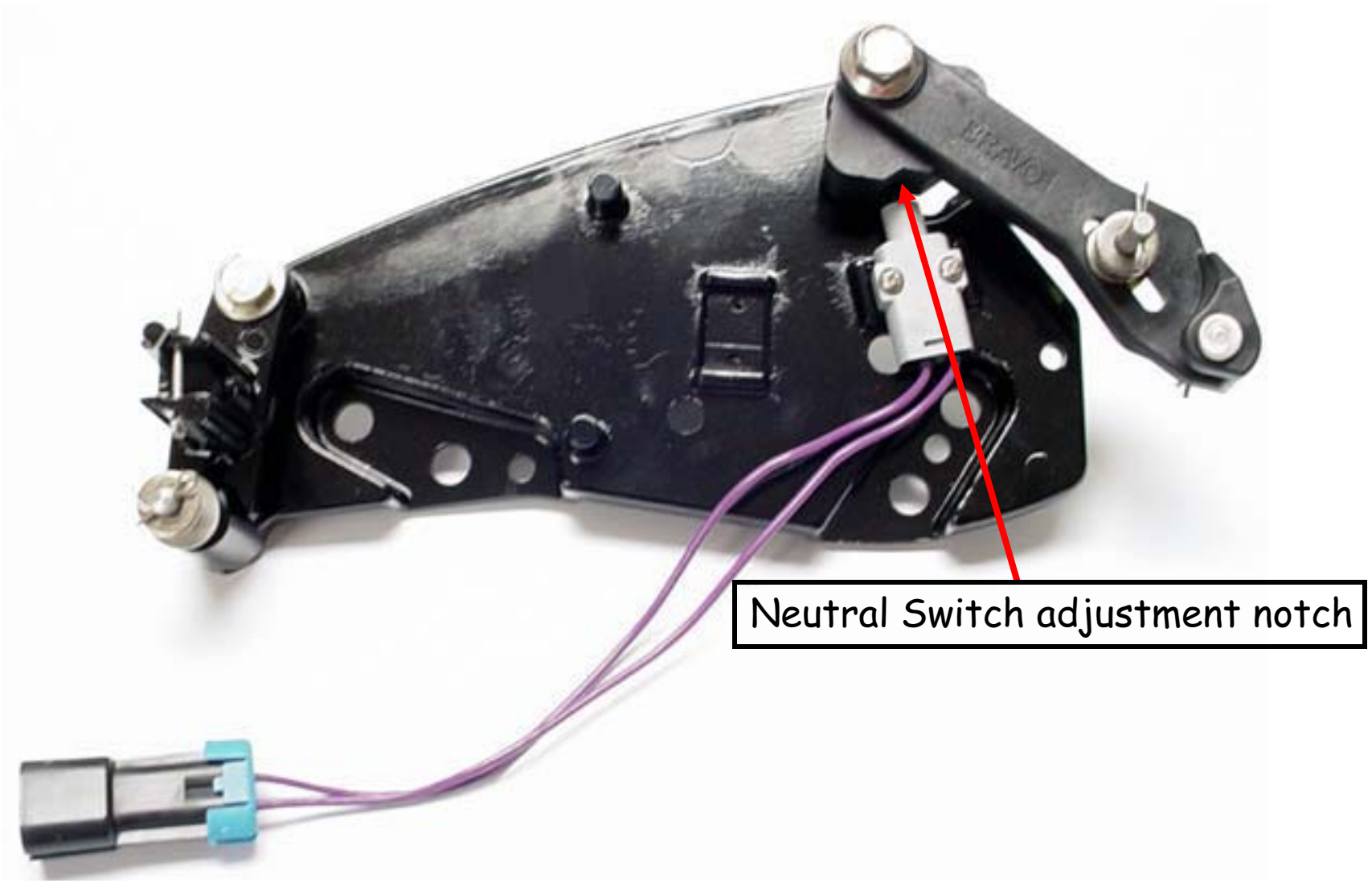


- **Project Definition**
  - Redesign shift plate assembly to eliminate improper installation of shift interrupt and gear indicator switches
  - Affects Alpha and Bravo
- **Benefits**
  - Eliminate failure / claims due to improperly assembled shift plate assemblies (switch plunger engagement)
  - Repeatable and consistent shift events
  - Decrease adjustments to shift cables
- **Impact**
  - Threaded stud/nuts replaced with stud and cotter pin
  - SOP June 17, 2003
  - Original release included hair pin Cotters,
  - changed to cotter pins on 8/23/03

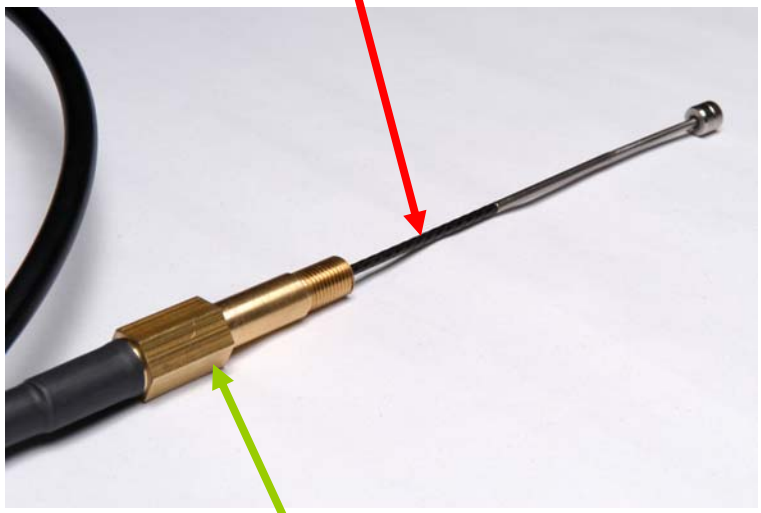
Alpha Shift Plate – Exploded View


Cable Tie
Cast in Switch Guide Bosses
ROUTE CABLE TIE THROUGH HOLE AND AROUND WIRE BUNDLE TO PROVIDE MAXIMUM CLEARANCE FOR SHIFT LEVER ASSIST
Cotter Pin
Cotter Pin
Clevis Pin
Shift Assist Assembly
Cotter Pin

New Shift Levers for Alpha & Bravo Shift Plate Assemblies


BRAVO I
Neutral Switch adjustment notch

Drive Initiatives – June 2003
Intermediate Shift Cable



- **Project Definition**
  - Alpha and Bravo intermediate shift cable redesign / resource to reduce friction and lost motion
  - Affects Alpha and Bravo
- **Benefits**
  - Reduce required bend radius
- **Impact**
  - Installs exactly as the old style cable did
  - Went into production on June 17th 2003

Alpha / Bravo Shift Cables

BRAVO
Intermediate Shift Cable

Part # 865437 A02

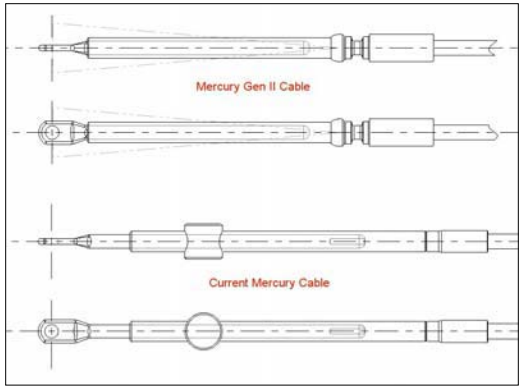
ALPHA

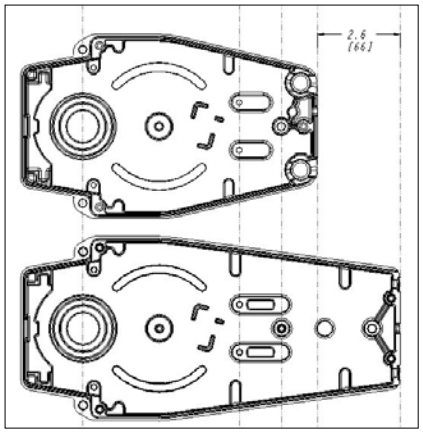
Intermediate Shift Cable

Part # 865436 A02

June 2003 Enhancements

- New internal “wig-wag” throttle and shift controls
  - Allows more flexible control cable routing
  - Reduced internal friction for smoother operation
  - Use new SAE-style control cables
  - Uses physically larger mechanism than previous generations





MERCURY MerCruiser

MERCURY
MerCruiser

2005
Product Update

5

Section 5

Sterndrives

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- Bravo Drive Shaft Housing Driven Gear Information
- Bravo Gear Upgrade Components
- Bravo Drive Shaft Housing Chimney Bearing Placement
- Bravo Chimney Bearing Removal Tool
- Bravo Lower Drive Shaft Comparison
- Standard and High Performance Prop Shafts
- Bravo Three Propeller Shaft and Oil Seals

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- Bravo III Bearing Carrier/Forward Propeller Issues
- Bravo Three Thrust Bearing Redesign

New for Bravo 2003/2004

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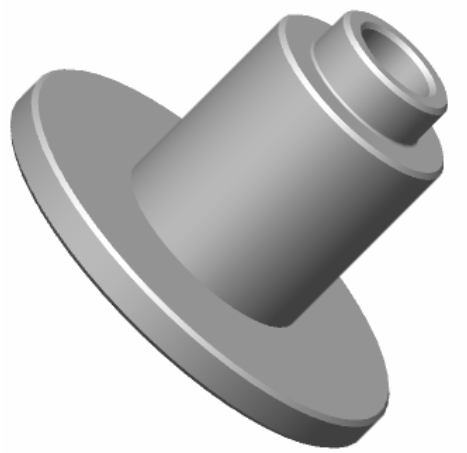
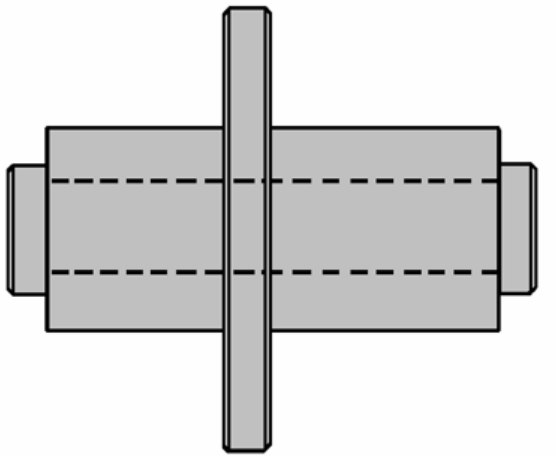
- Bravo Cone Clutch Redesign
- Bravo Drive Shaft Housing Restyling
- Shift Shaft Cavity Seal Redesign

New Bravo 2004 Shimming Process

New Alpha One Generation II
Drive Shaft Housing Oil Seal Installation Tool



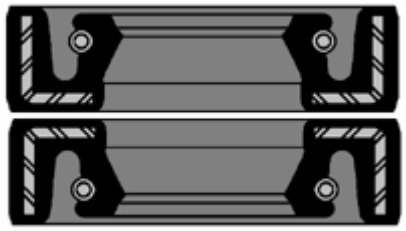
91-864497 New Integrated Oil Seal Installation Tool



91-817570T (Two Seal Installation Tool)

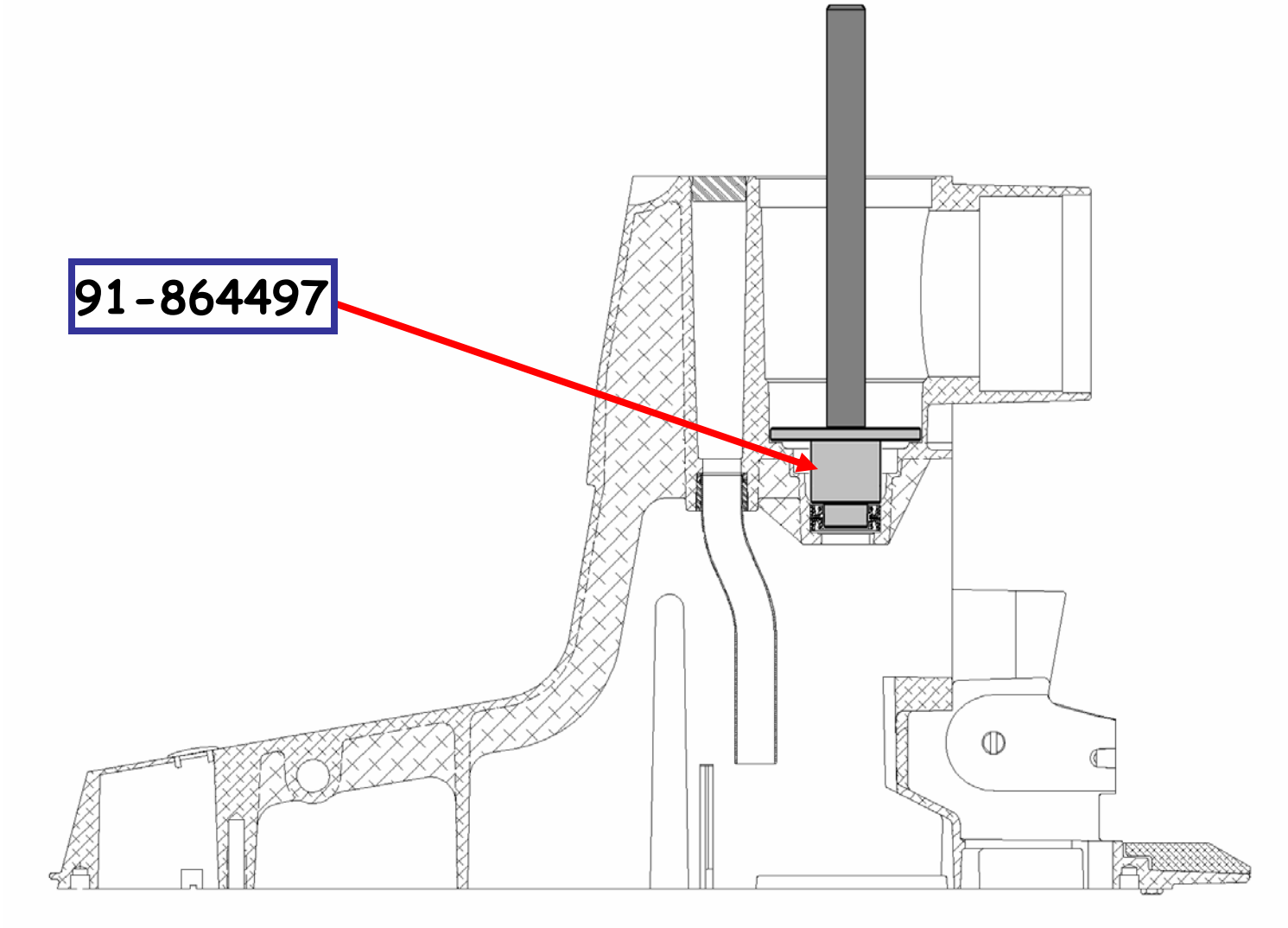
New Integrated Oil Seal

Part Number 26-864319



Old Style (Back to Back) Oil Seal Installation Part Number 26-66302

New Alpha One Generation II Drive Shaft Housing Oil Seal Installation Tool



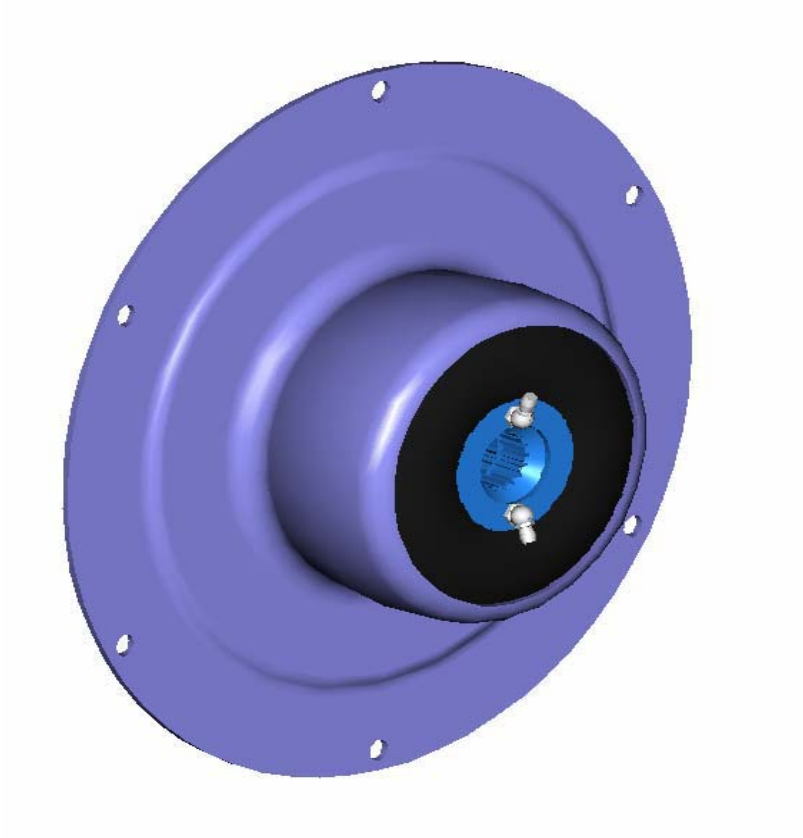
Bravo Drive Updates and Changes

Drive Initiatives – January 2004
Improved Engine Coupler – Bravo Only

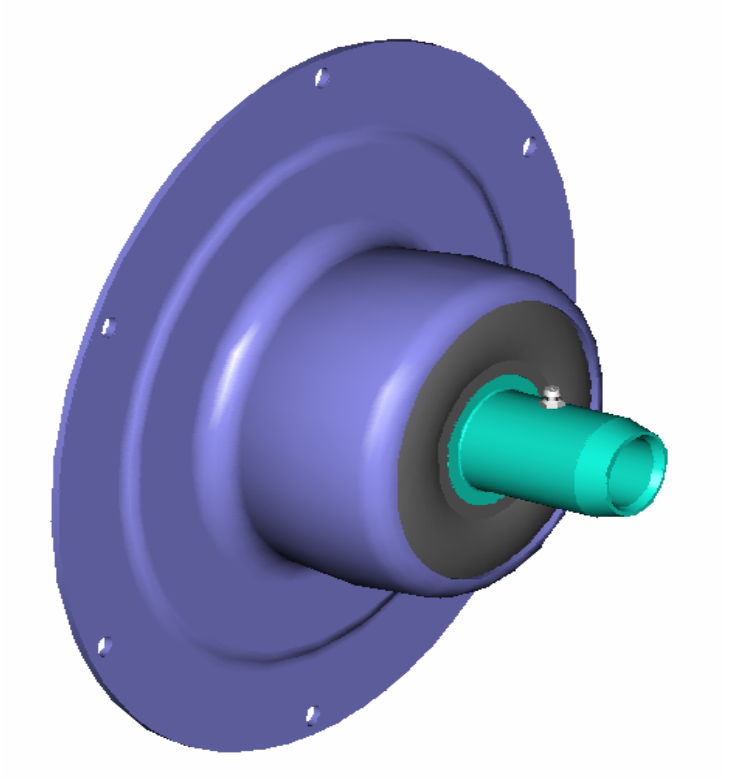
Design to be finalized by the end of February 2004

- **Project Definition**
  - Change hub material from Aluminum to 12L14 Steel
  - Affects All V8 Bravo engine couplers only.
  - No change to Alpha couplers
- **Benefits**
  - Improved spline durability
  - Sealed to maintain the grease internal to the splines
  - **Extended maintenance intervals to 300 hrs**
- **Impact**
  - SOP – Moved out to the fourth quarter in 2004

Bravo Engine Couplers

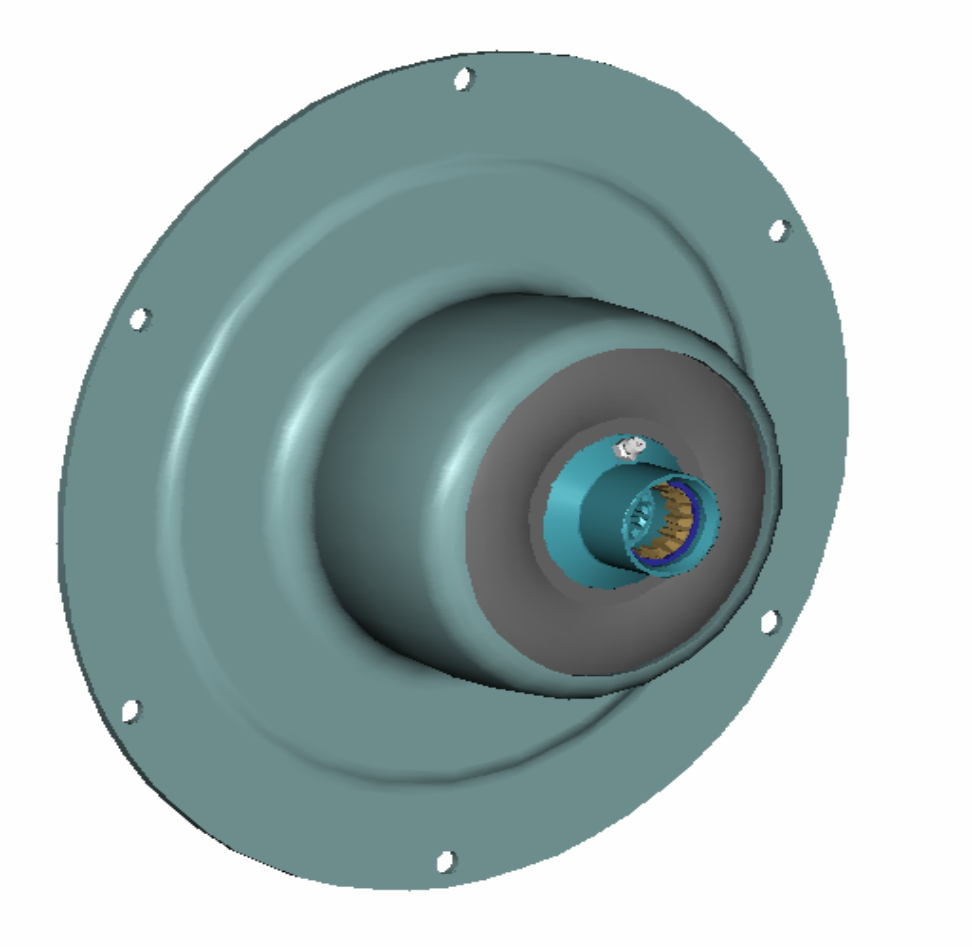


Current Bravo Small Block

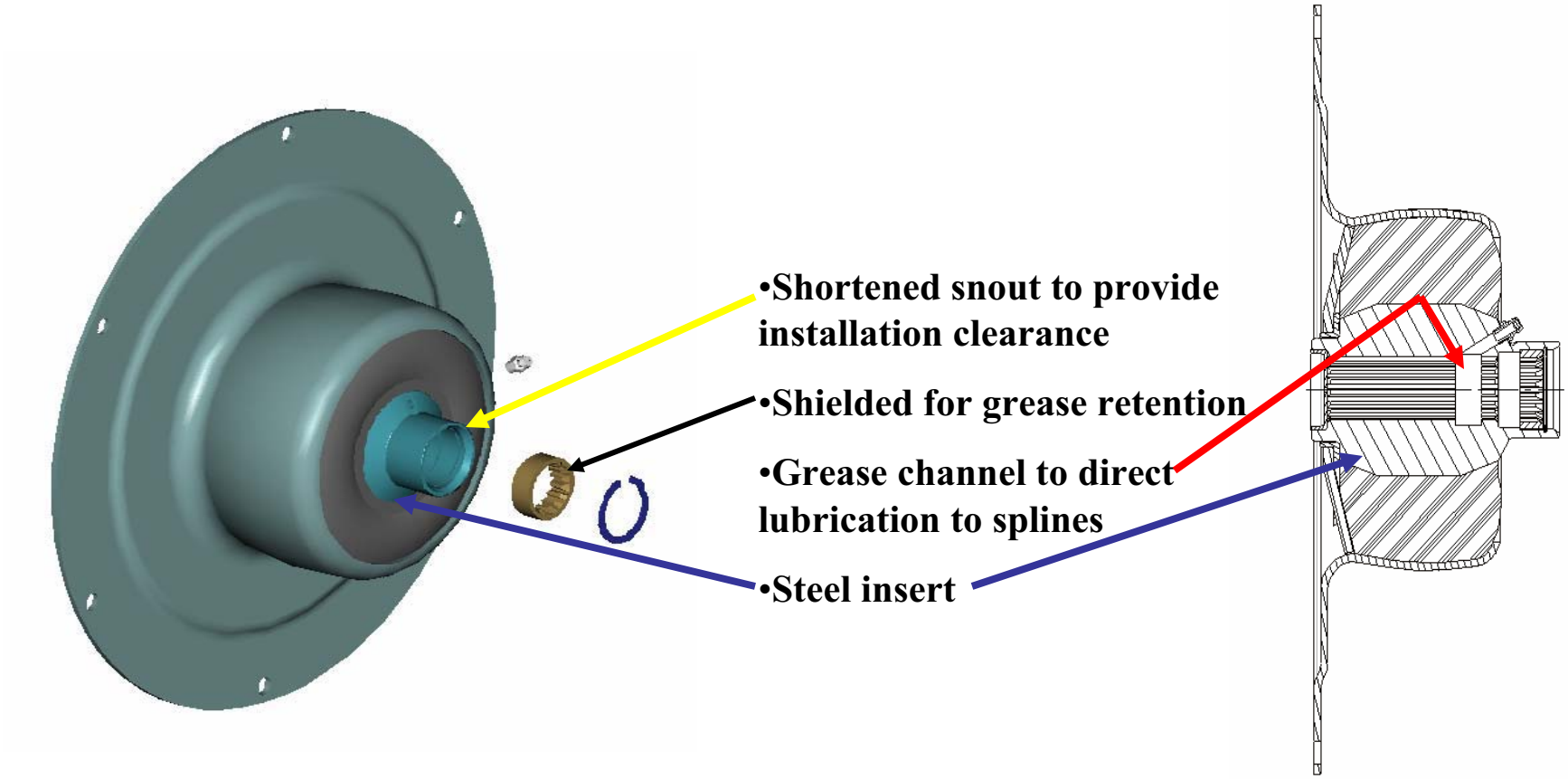


Current Bravo Big Block

Proposed New Design Bravo Engine Coupler



Proposed Bravo Gas Engine Coupler Design


•Shortened snout to provide installation clearance
•Shielded for grease retention
•Grease channel to direct lubrication to splines
•Steel insert

Bravo Universal Joint Assy.

- The Bravo U-Joint Assembly has changed from the Rockwell U-joint assembly to the GKN assembly.
- The Rockwell assembly is **Gray** in color, where as the GKN assembly is **Black** in color.
- The Rockwell assembly has the Cross & Bearing end caps retained with clips at the bottom of the cap inside of the yoke ear.
- The GKN assembly has the Cross & Bearing end caps retained with the clips above the cap on the outside of the yoke ear for Standard Bravo and Alpha.
- The Rockwell U-Joint assembly was a greaseable assembly.
- The GKN is a Permalube style like the Alpha U-Joint assembly and cannot be greased.
- The GKN **Bravo X** assembly is **Black** in color and has the Cross & Bearing end caps retained with clips at the bottom of the cap inside of the yoke ear as did the [Bachman U-Joint Assembly] Rockwell style.

Comparison of Rockwell to the GKN U-Joint Assy.

GKN U-Joint Repair Parts
Alpha / Bravo Std.

- ***ALPHA***

Universal Joint Assembly	864281A 2
Stub Yoke Gear End	864282T
Center Socket	865503T
Splined Yoke Engine Coupler End	864281A01
Cross and Bearing Assembly	865493A01

- ***BRAVO Std.***

Universal Joint Assembly	864244A 2
Stub Yoke Gear End	864245T
Center Socket	865503T
Splined Yoke Engine Coupler End	864244A01
Cross and Bearing Assembly	865496A01

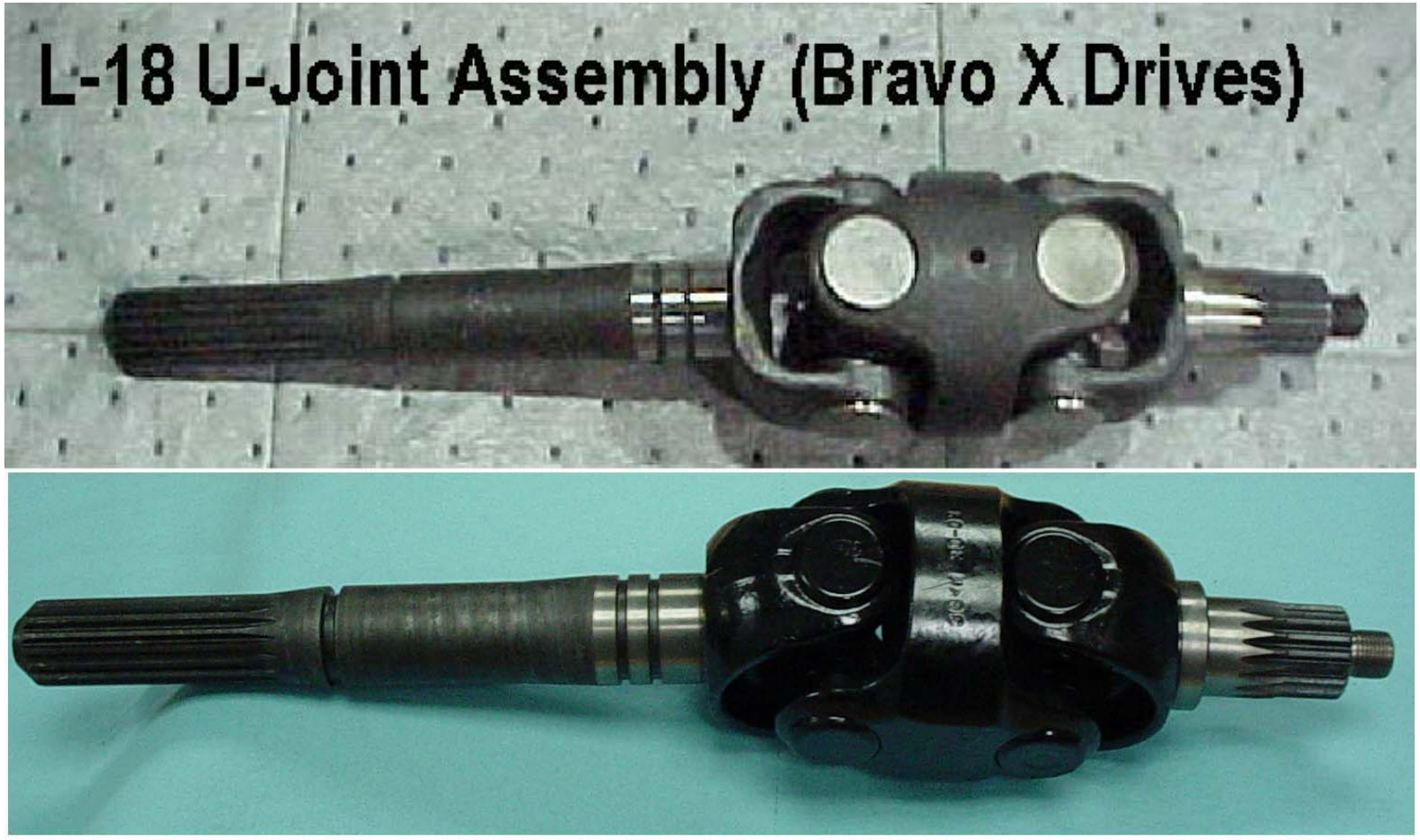
Rockwell U-Joint Assembly

Bravo Standard
GKN U-Joint Assembly

Bravo “X”
GKN U-Joint Assembly

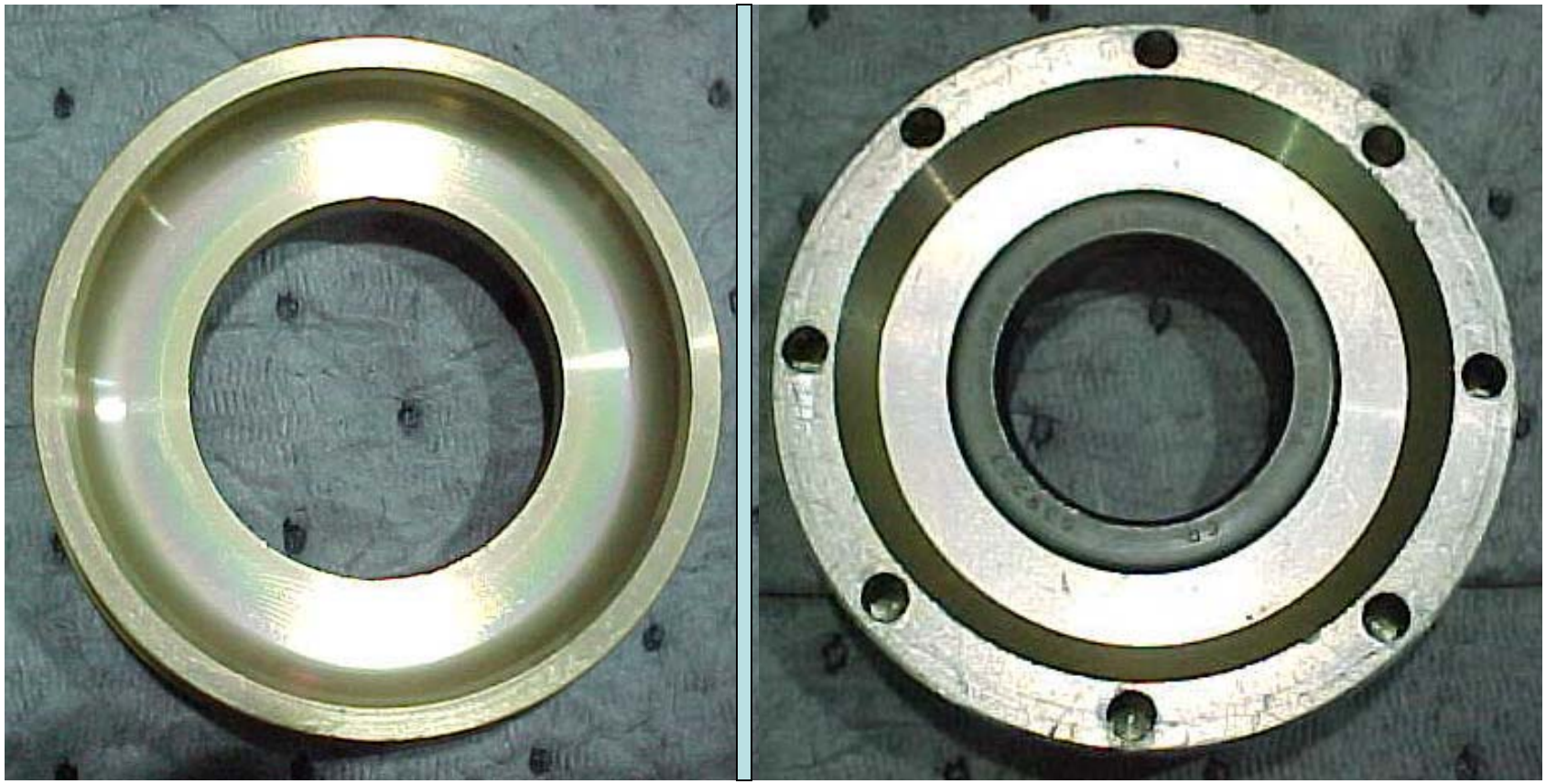
Repair parts for the GKN “X” Drive U-Joint Assembly such as the part numbers for all of the individual replacement parts are being worked on and will be brought out at a later date in 2004

Bravo (X)
U-Joint Assemblies

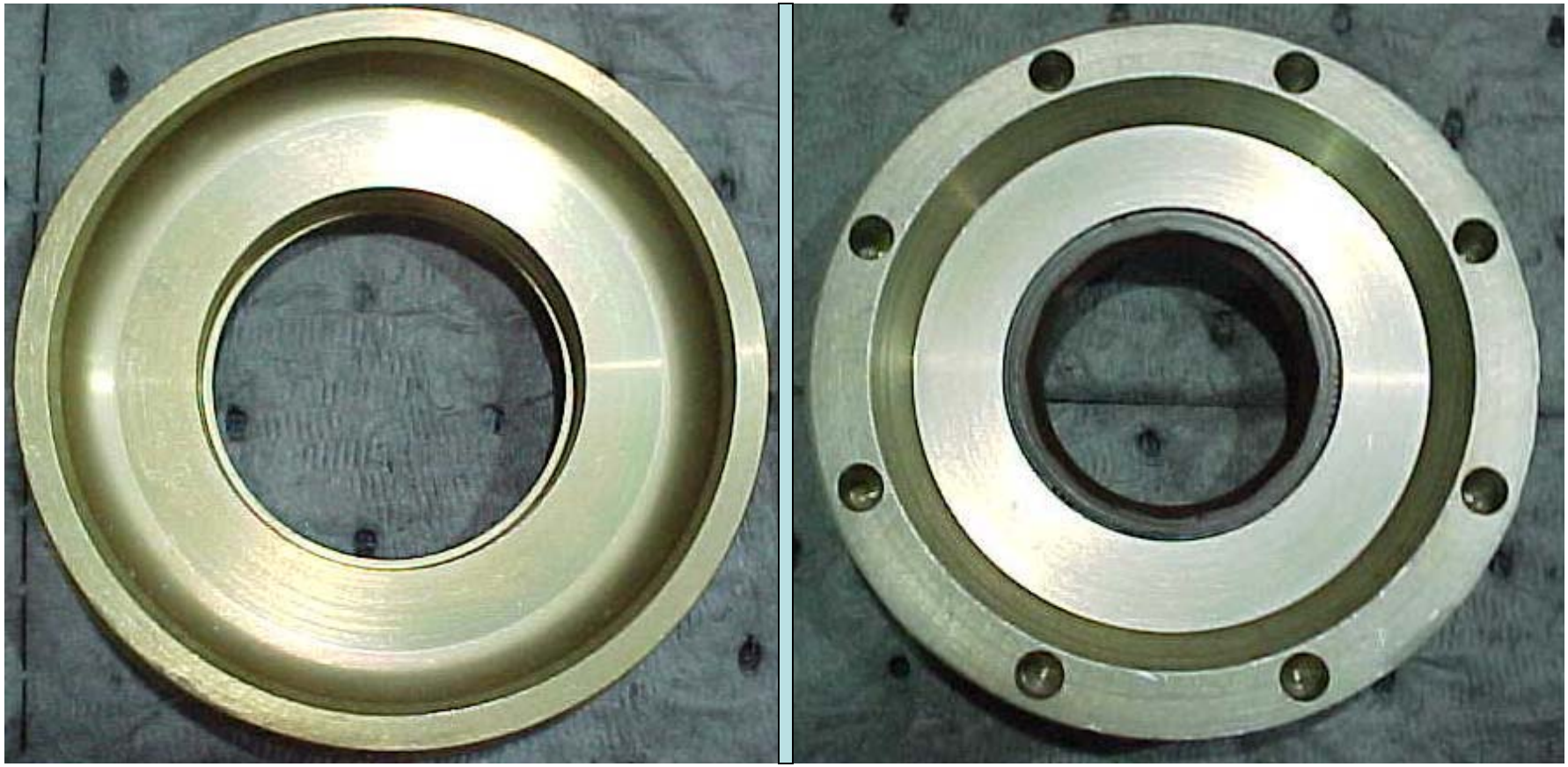


New L18 GKN U-Joint Assembly (Bravo X Drives)

Standard Bravo (X)
U-Joint Retainer Nut



New Bravo One XZ/XR U-Joint Retainer Nut



Bravo X/XZ/XR U-Joint Retainer Nut Oil Seals

Bravo One XZ/XR

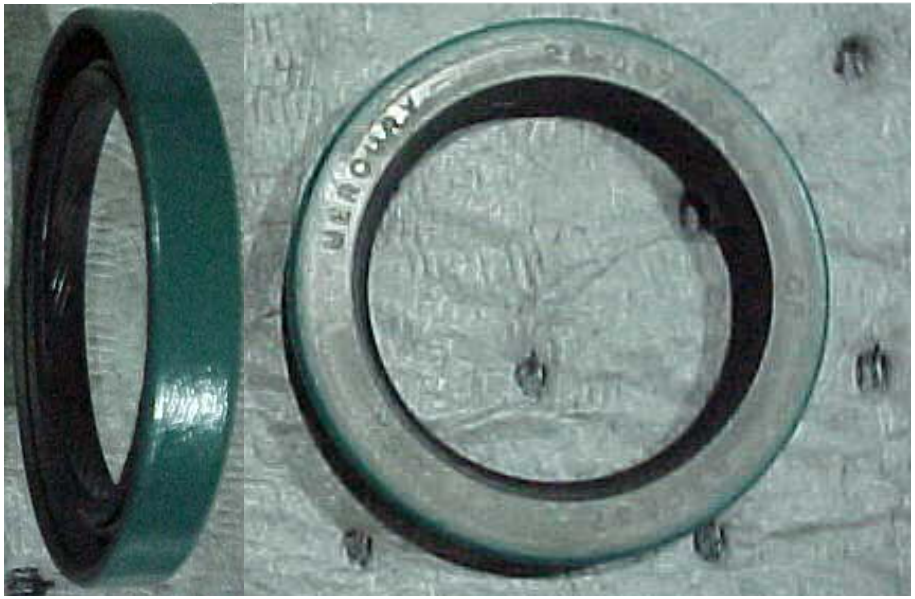
U-Joint Retainer Nut

Oil Seal

Bravo One/Two/Three X

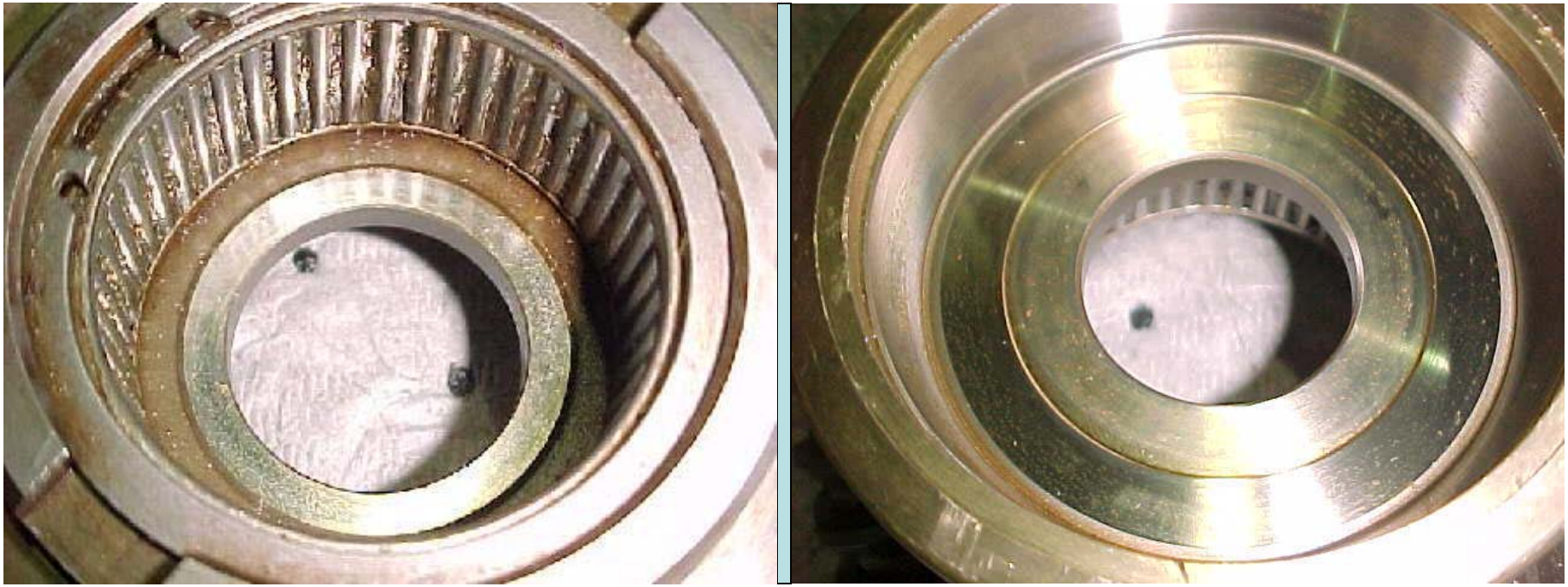
U-Joint Retainer Nut

Oil seal



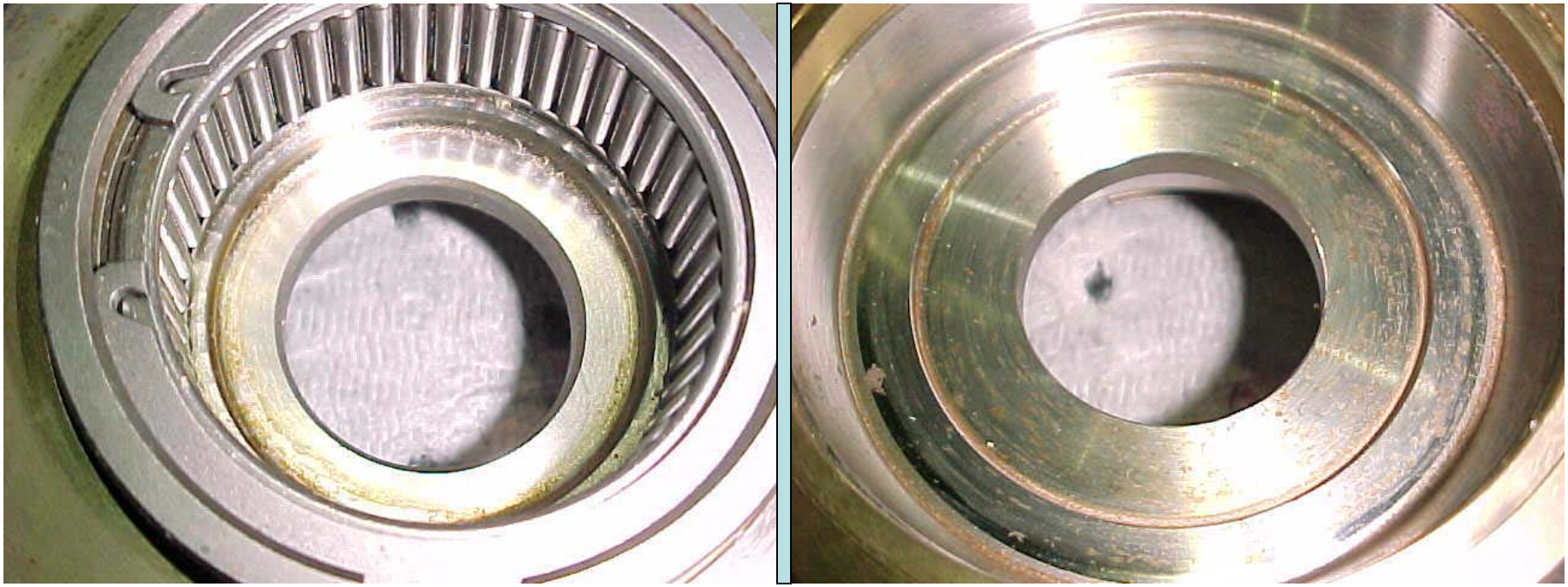
Original Style Bravo Driven Gear for 1999 and Prior Units

- **Original style Driven gear (1999 & Prior)**

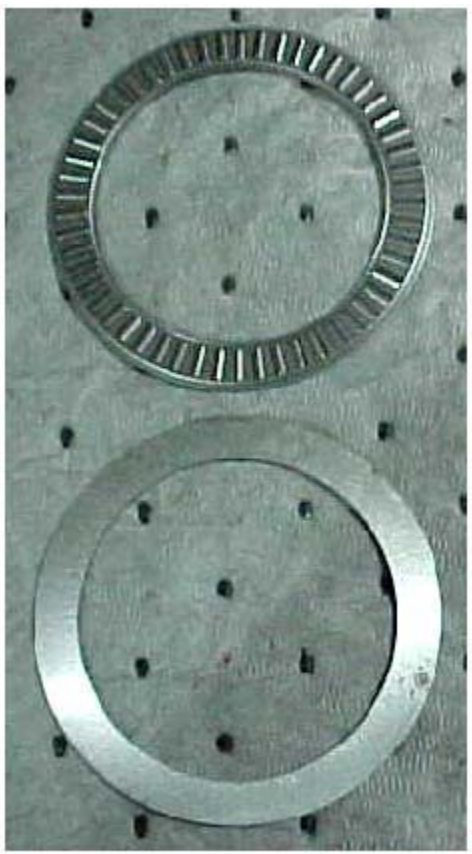


Bravo Gear Upgrade for 1999 and Prior Units as well as Current Product

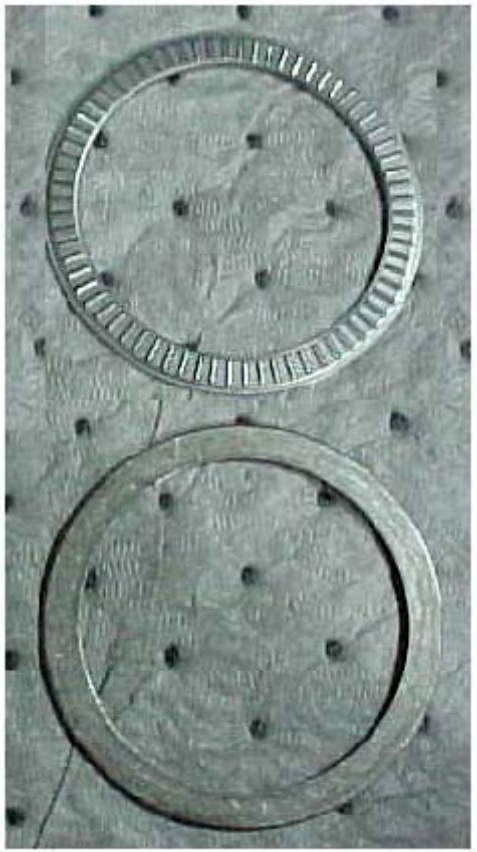
- New style Replacement Gear for 1999 & prior as well as current Bravo Drives.



Thrust Bearing for Driven Gears on 1999 and Prior Units Plus the New Upgrade Thrust Bearing.



New Thrust Brg. & Race



Older Thrust Brg. & Race

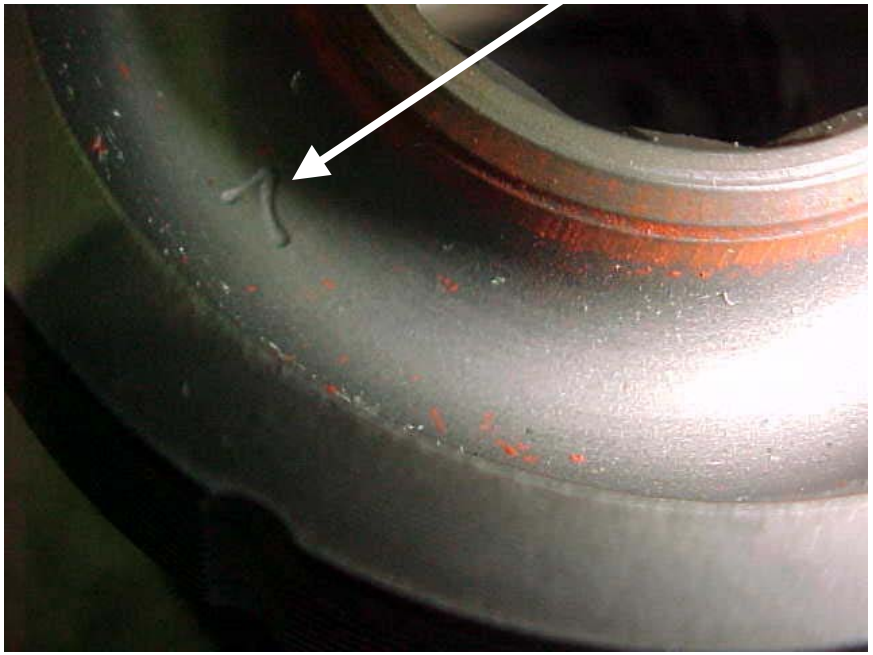
Garter Spring Thrust Bearings for Bravo Gear Upgrade on 1999 and Prior Units

New Style One Piece
Garter Spring Bearing

Old Style Two Piece
Garter Spring Bearing

Cone Clutch Differences for Bravo Gear Upgrade for 1999 and Prior Units

- Old Style Cone Clutch
- with the number “7”



New Upgrade cone clutch with the Top Groove

Original Chimney Bearing Placement on 1999 and Prior Bravo Drive Units

- Original Chimney bearing positioning for 1999 & prior Bravo Drives

New Chimney Bearing Placement on 1999 and Prior Bravo Drive Units

- Proper positioning of the Top Cover and Drive Shaft Housing Chimney Bearing.

Bearing Drivers for the Bravo Chimney Bearing and Roller Brg.

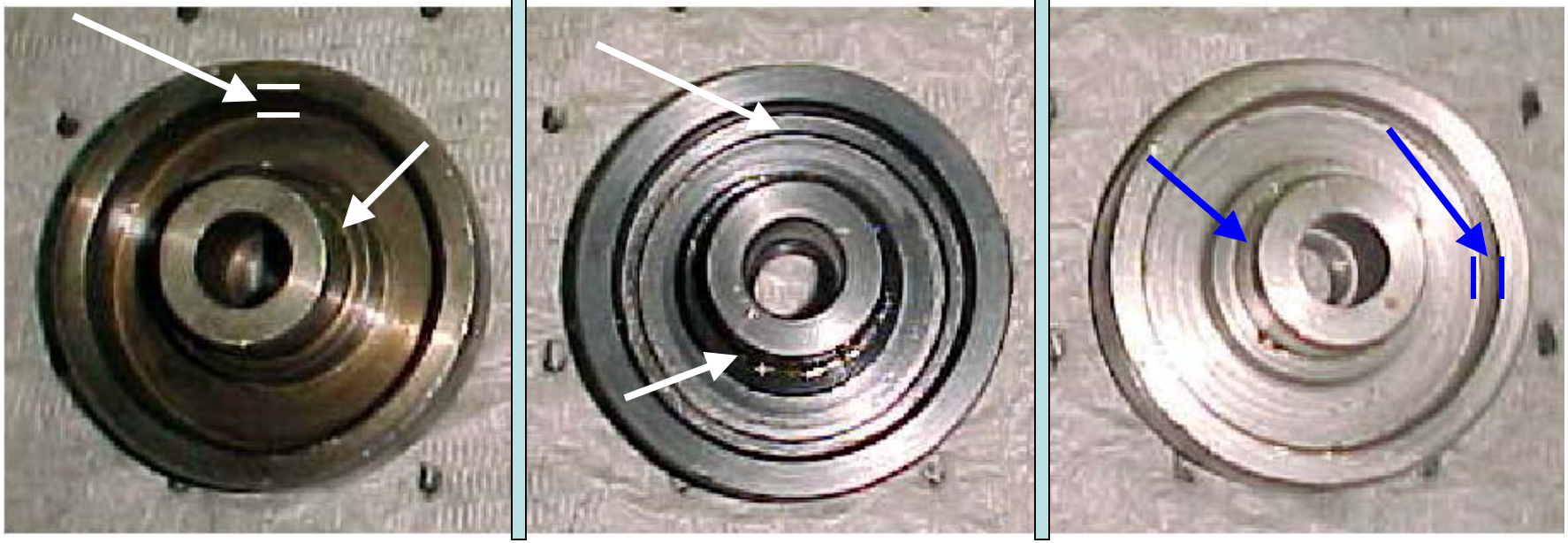
- 91-90773T
- Original

91-864220

Upgrade

91-862530

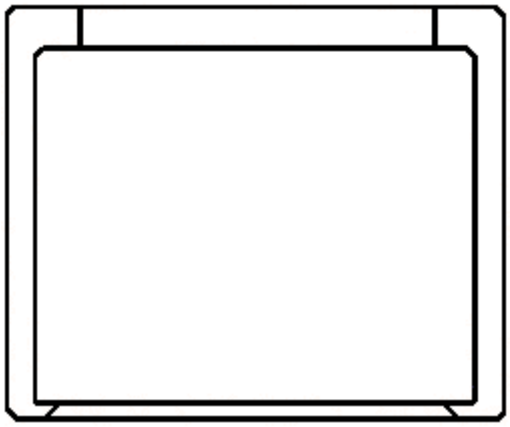
2000 & up



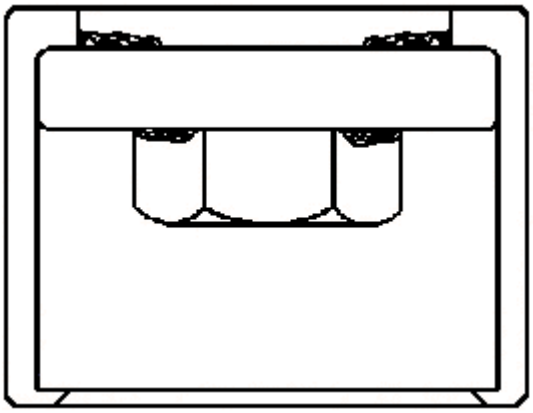
Bravo Chimney Bearing Removal Tool

Individual Replacement Puller Tool part Numbers for Bravo Service Tool 91-90244A 1

Bravo Service Tool 91-90244A 1 replacement part numbers. When you order part number 91-90777T1 puller Jaw, used to remove the sleeve bearing from the Top Cover Bearing Chimney or the Driveshaft Housing Bearing Chimney, you only receive one half of the tool. Part number 91-90778 puller jaw will also have to be ordered to make the puller tool complete.



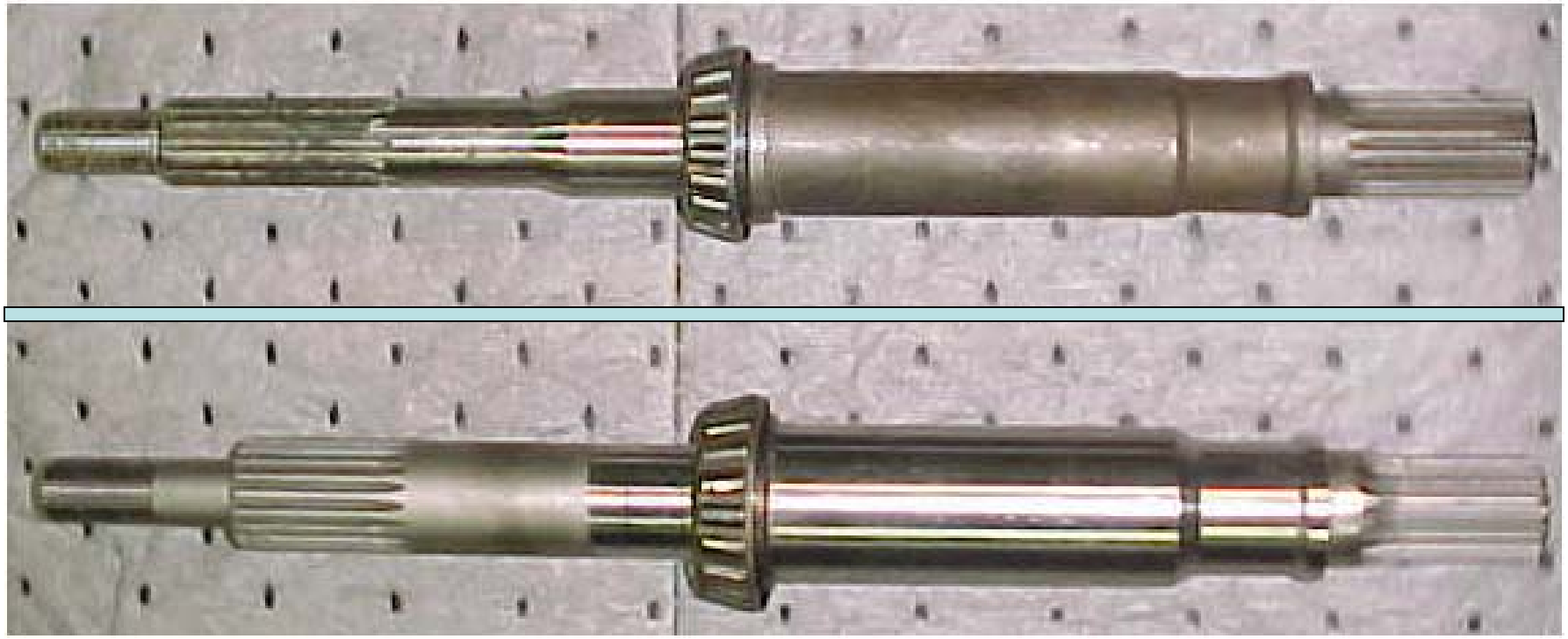
91-90778



91-90777T1

Bravo Lower Driveshaft Comparison

Standard Prop shaft versus High Performance prop shaft



Bravo Three Propeller Shafts and Oil Seals

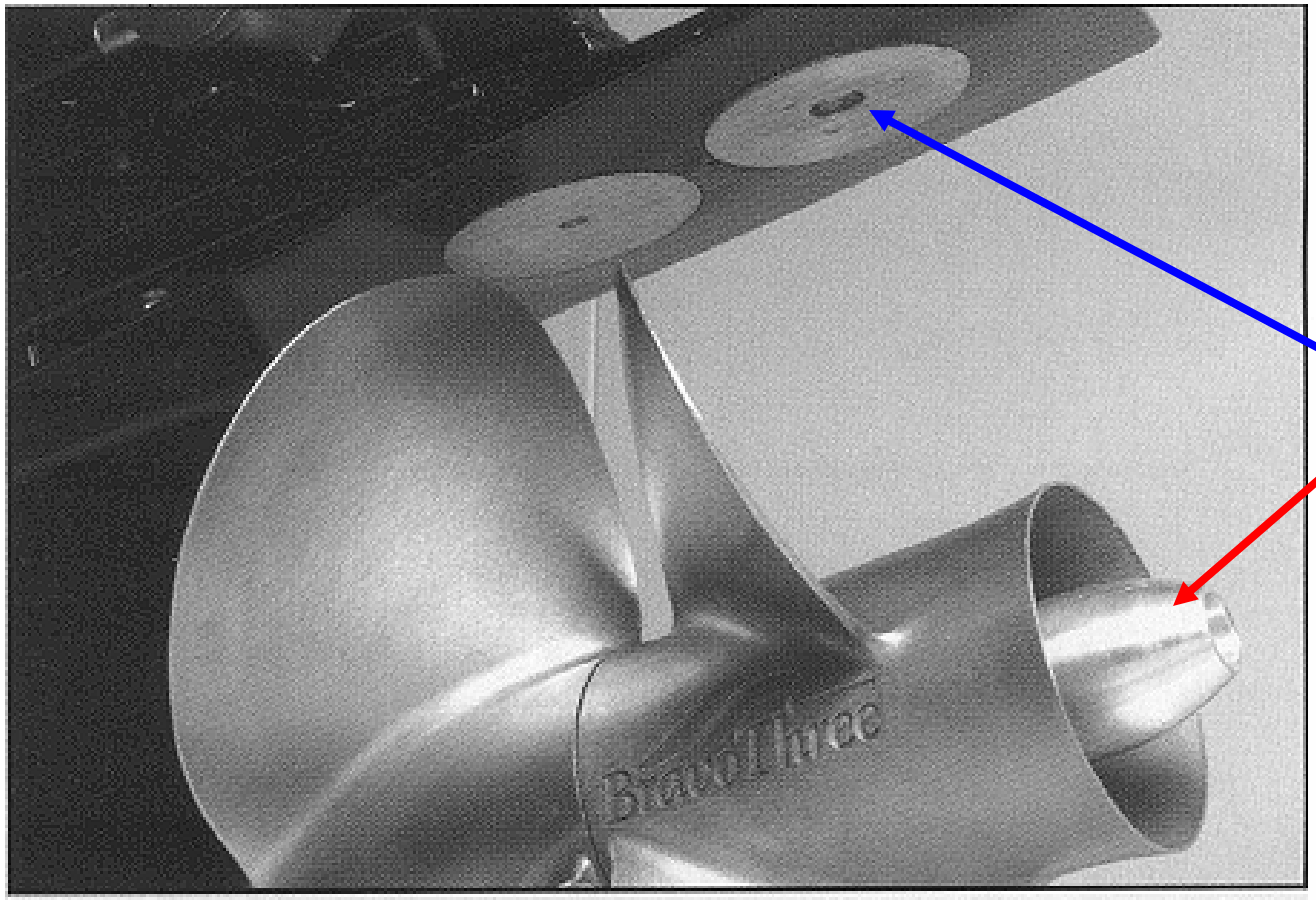
- We have had some reports of Bravo Three propeller shaft oil seal leakage.
- Samples of the production oil seal were placed on test in our engineering test cells to check for leakage.
- The oil seals were also measured by our quality department to make sure that they were made to print.
- After measuring oil seal samples that were taken from production, the seals were found to be out of print.

Bravo Three Propeller Shafts and Oil Seals (continued)

- The seal vendor was then contacted to set up a meeting on the quality and design issue of the oil seal.
- The first thing that was done was to increase the ID of the Urethane retainer at the outside seal towards the propeller.
- The next thing that was done was to have the vendor make the oil seals to print and air freight them to our facility for testing.
- The new oil seals that were made to print were much better.
- Our next step is to get a total new redesign for the oil seal and that is in process at this time.

- New improved propshaft seals – Bravo Three
  - New lip design, material and spring tension
  - Greatly reduces potential for leakage and early failure

Bravo III Changes for 2003



Further enhancing the standard MerCathode corrosion protection, all Bravo Three drives now feature additional protective anodes on the anticavitation plate and propshaft.

Additional Anode added to Gear Case and Propeller Shaft on June 17, 2003 S/N 0M179452

Bravo III Anode Design Targets

- Add **43%** Anode Volume w/ Dual Gearcase and Propeller shaft Anode
  - Baseline -current 17.41 in^3 (285.3 cm^3)
  - Actual - added 4.52 in^3 (74.07 cm^3) – 25.9 % increase w/ propeller shaft anode
  - Actual – added 2.79 in^3 (45.72 cm^3) - 16 % increase w/ dual gearcase anode
  - Actual – total added 7.31 in^3 (119.79 cm^3)- **41.9%** w/ propeller shaft and dual gearcase anode

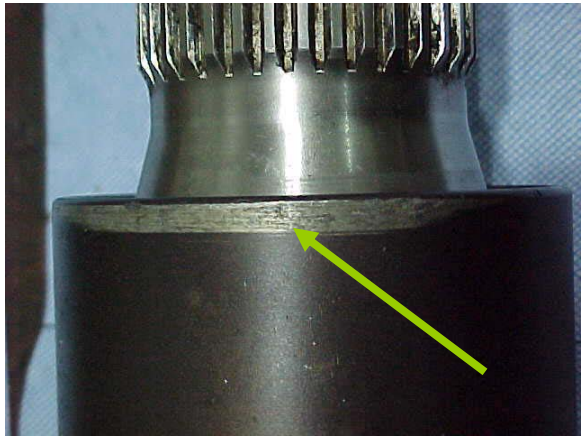
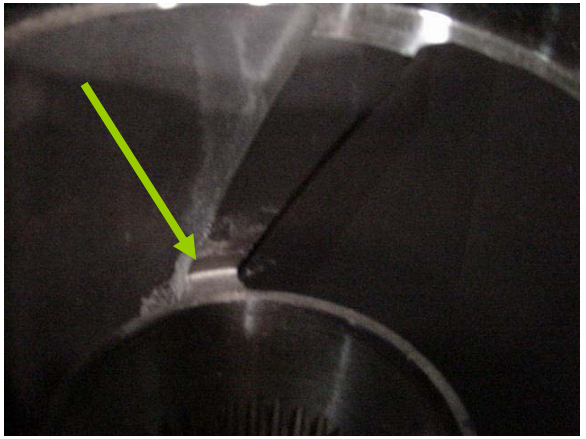
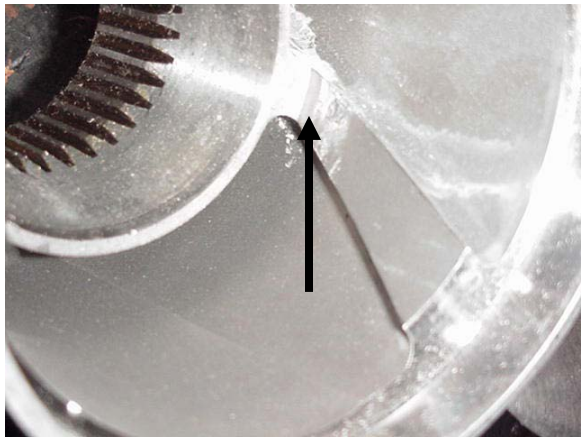
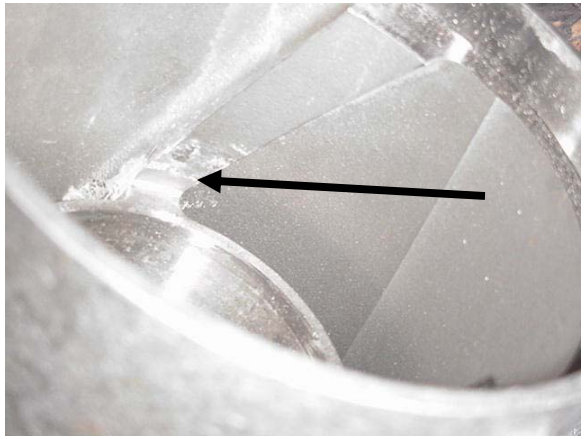
- Increase Hull Potential to Improve Protection
  - Freshwater target 750 – 1050 mv
  - Saltwater target 850 – 1150 mv

Bravo III Bearing Carrier

Bravo Three Bearing Carrier / Forward Propeller

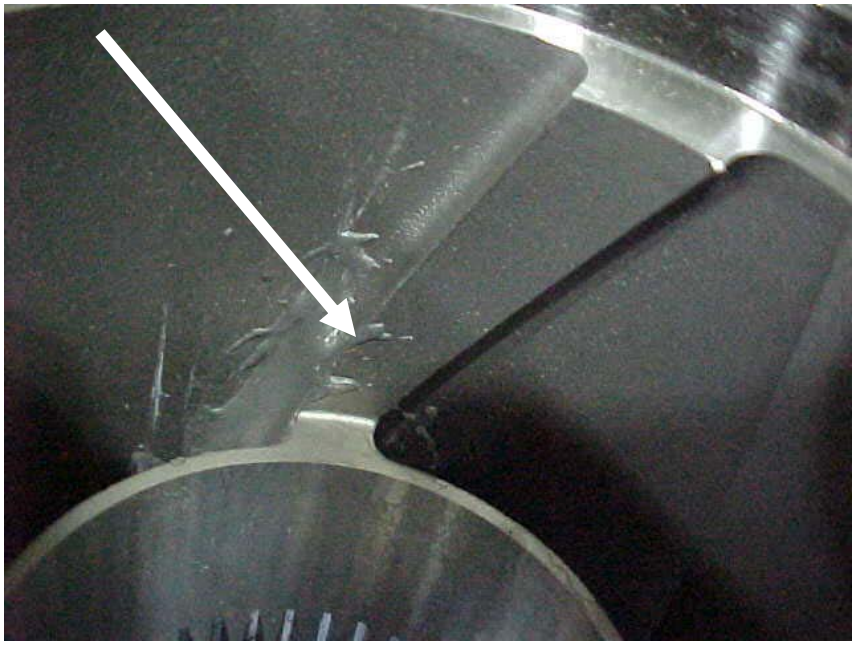
- You may have also heard that the front propeller was hitting on the bearing carrier causing some surface rub damage.
- It was found to be several issues.
- 1) The ID of the front propeller is now opened up by an additional one hundred thousands per side to eliminate any possible rub.
- 2) The propellers were not within the balance specifications of the print and were adding to the oil seal leaks as well as the hitting on the carrier.
- 3) There was some Devcon that is used as a filler for small amounts of porosity in the casting that was hitting on the bearing carrier, Devcon is a filler material commonly used in most all of the Stainless steel cast process propellers as a filler for porosity.
- 4) There was some casting flash that had not been properly cleaned out of the bottom radius of the bore causing some of the rubbing.

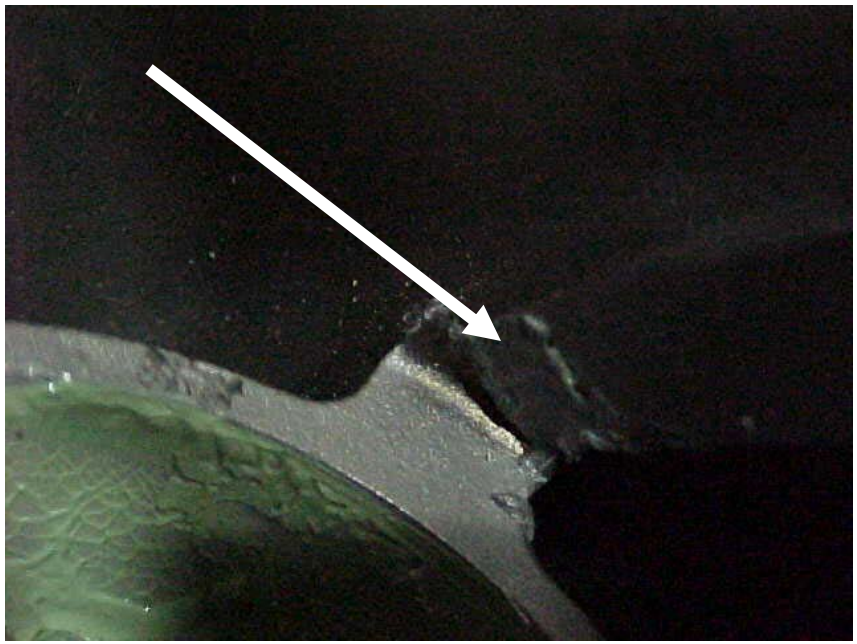
Bravo Three Bearing Carrier Damage / Propeller Defect

Bravo Three Bearing Carrier Damage / Propeller Defect

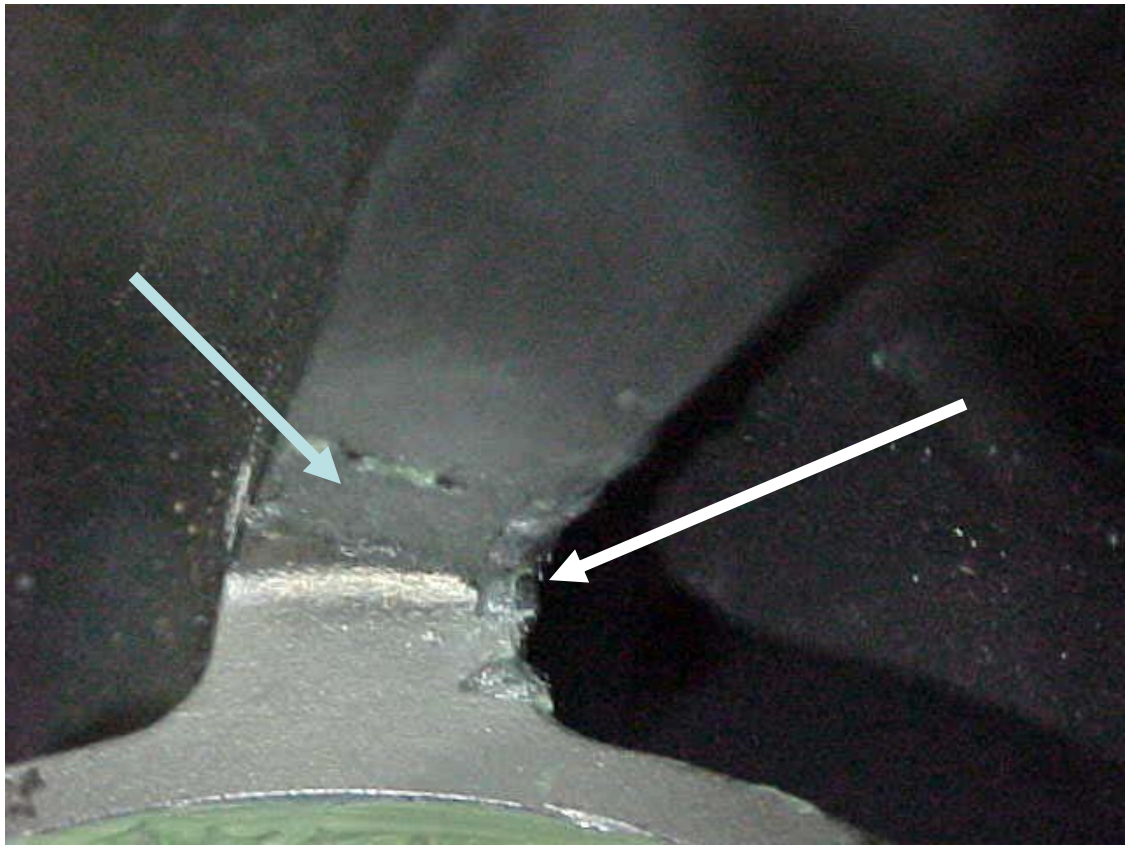
- Heavy deposit on lower rib of propeller causing it to rub on the bearing carrier.
- Heavy Devcon Deposit on lower section of rib on inner propeller, causing it to rub on the bearing carrier.





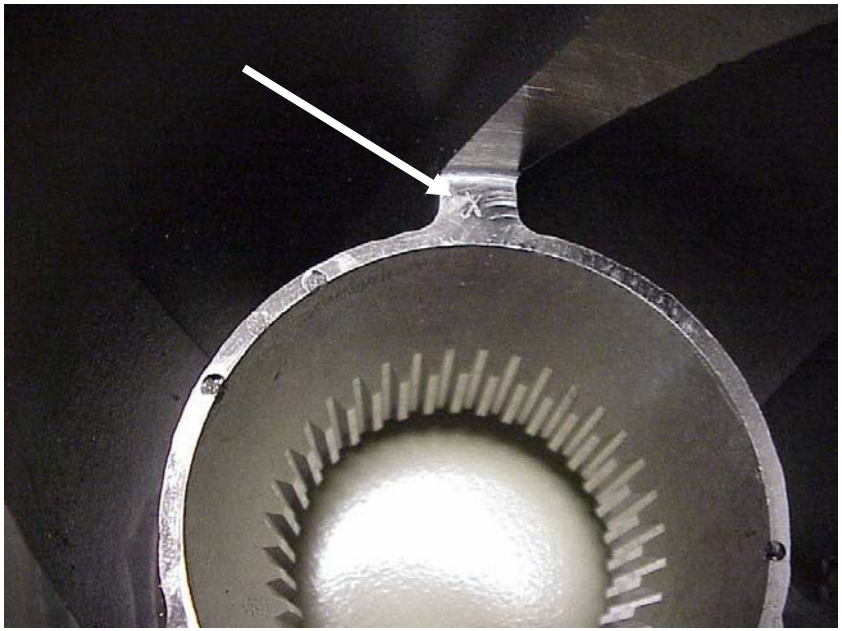
Bravo Three Bearing Carrier Damage / Propeller Defect

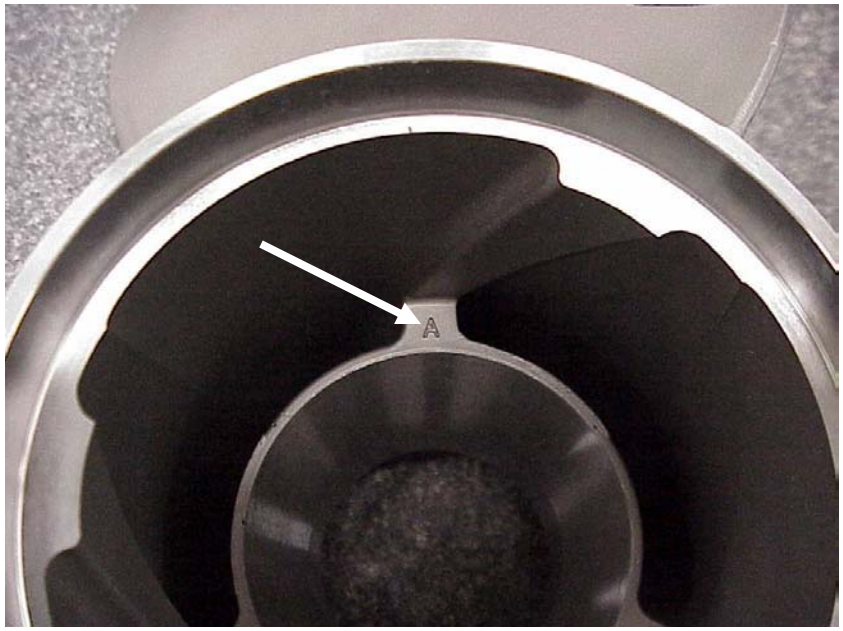
- Casting Flash on leading edge of propeller rib, Devcon across the face of the rib causing the propeller to Gaul on the bearing carrier.



Bravo Three Bearing Carrier Damage / Propeller Defect

- The new version of the front propeller.
- Version One is the Machined current version using the letter (X) as an identifier.
- Version Two is the new Cast version using the letter (A) as an identifier.





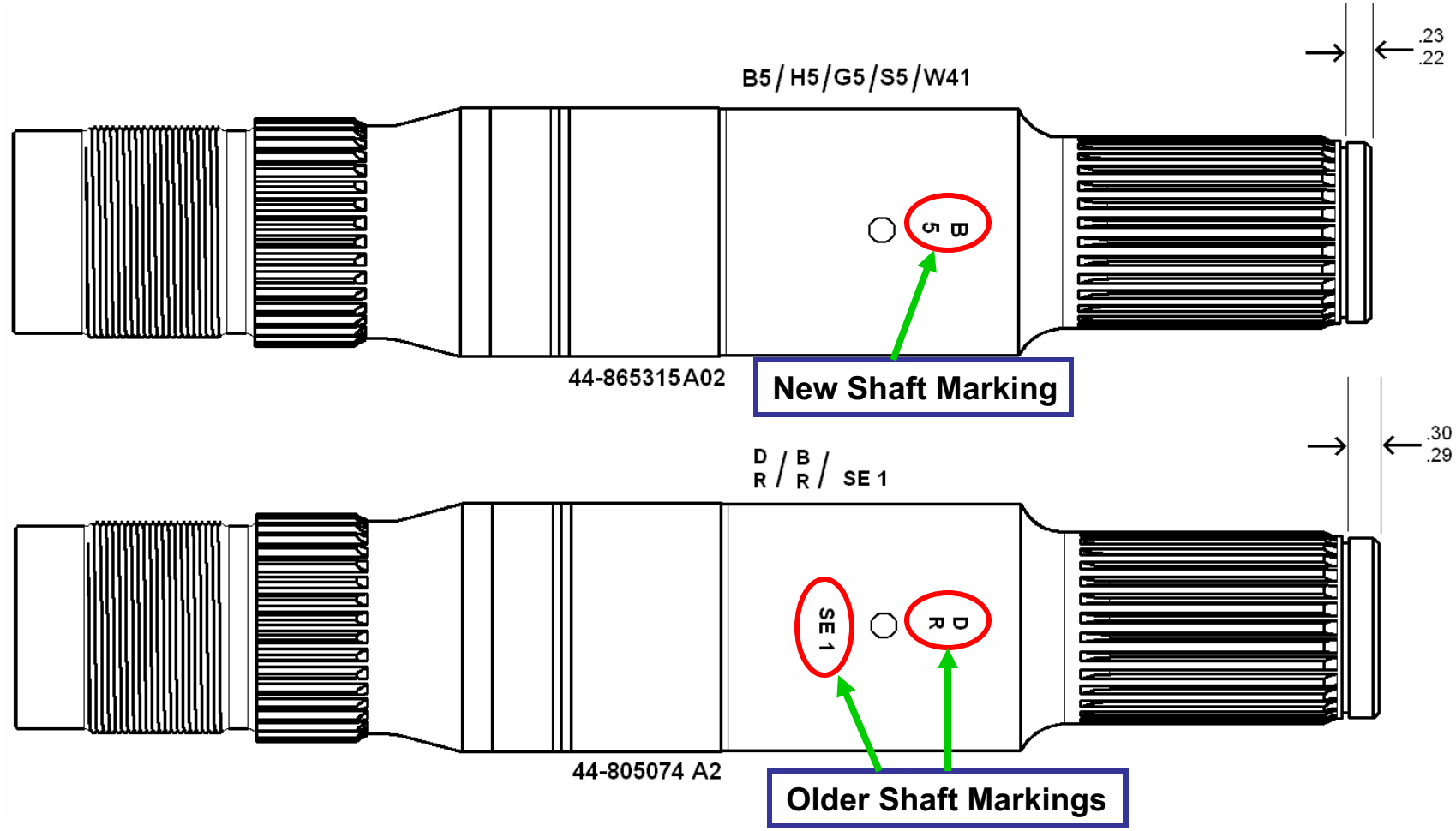
Drive Initiatives – January 2004
New Thrust Bearing

Current Design

New Design

- **Project Definition**
  - Redesigned bearing to improve durability.
  - Increased roller diameters
  - Bravo III only
- **Benefits**
  - Longer Bearing Life
  - Dynamic Load Rating
- **Impact**
  - SOP – January, 2004

Drive Initiatives – January 2004
New and Old Outer Propeller Shaft



New for Bravo in 2003 /2004

Drive Initiatives – May 2004

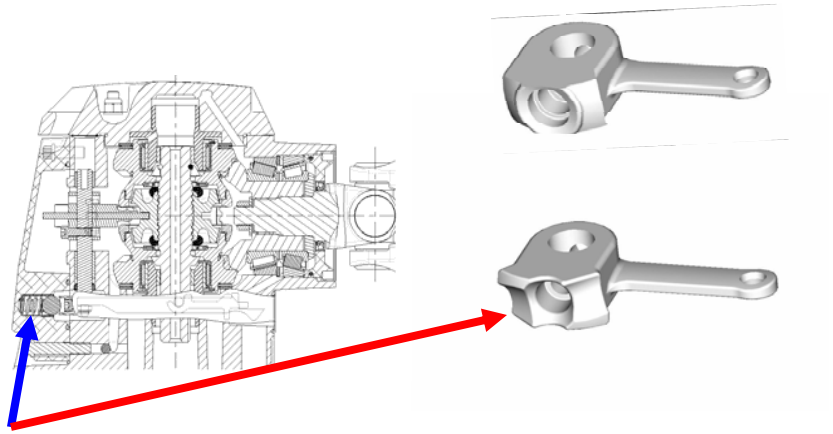
- **Project Definition**

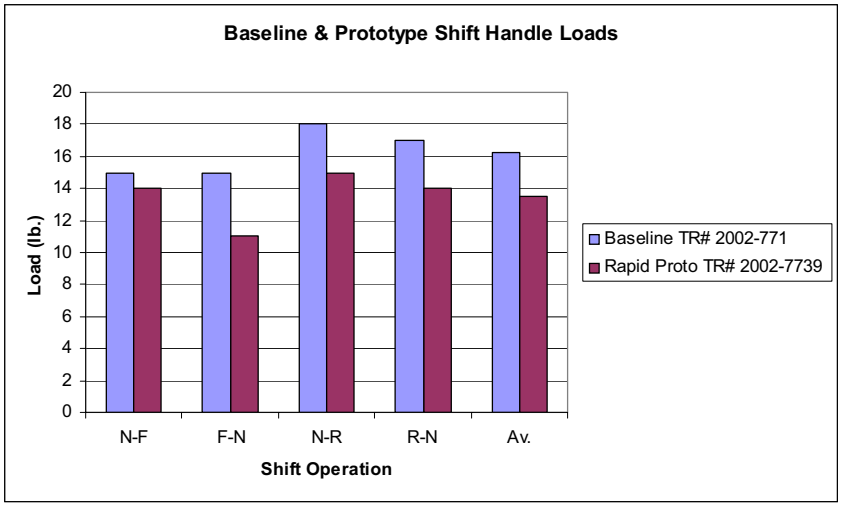
  - **initiatives directed at improving the following:**
    - **NVH / Shift Effort**
      - **Bravo shift lever detent**
      - **Revised engine management during shift event ECM / PCM**
      - **Bravo Clutch Geometry**
    - **Bravo Styling**
      - **Ribbed Top Cover – Bravo (X) Only**
      - **Drive Shaft Housing, Top Cover & Rear Cover**
      - **Decals**
  - **Start of Production**

May 31, 2004

  - **End Model Number Change**

Drive Initiatives – May 2004
Bravo Shift Lever Detent





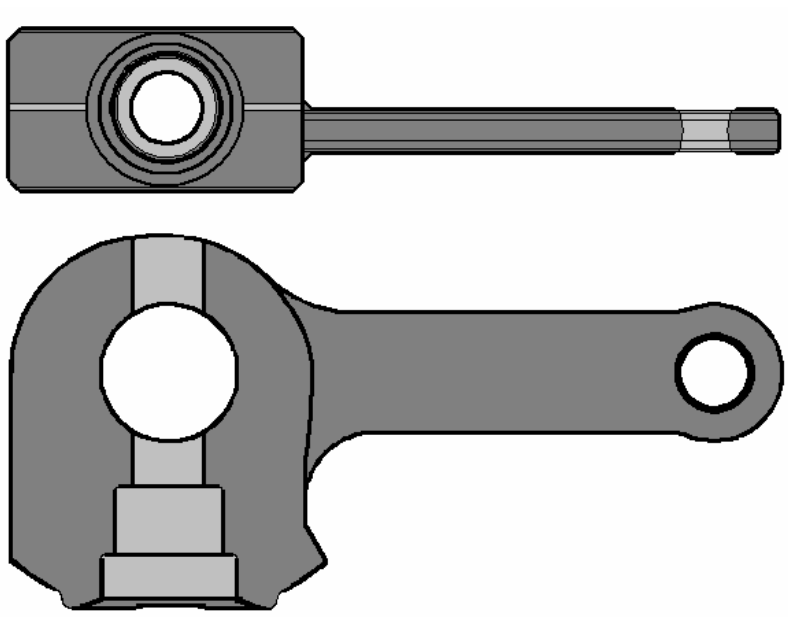
- **Project Definition**
  - Modify Detent Shape
  - Smooth detent transition from forward into neutral and from reverse into neutral.
  - Improve positioning of detent canister
  - Affects Bravo Drives only
  - Not applicable to Bravo X Drives
- **Benefits**
  - Reduces shift loads measured at control handle by 17%
  - NVH Improvement

Impact

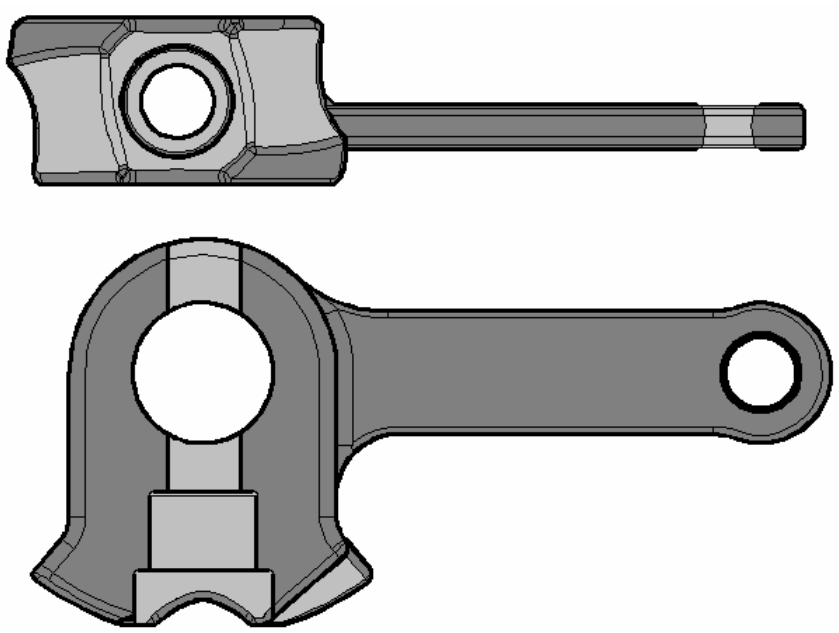
- Standard Bravo Drives only

SOP – May 31, 2004

Bravo Shift Lever Detent Socket

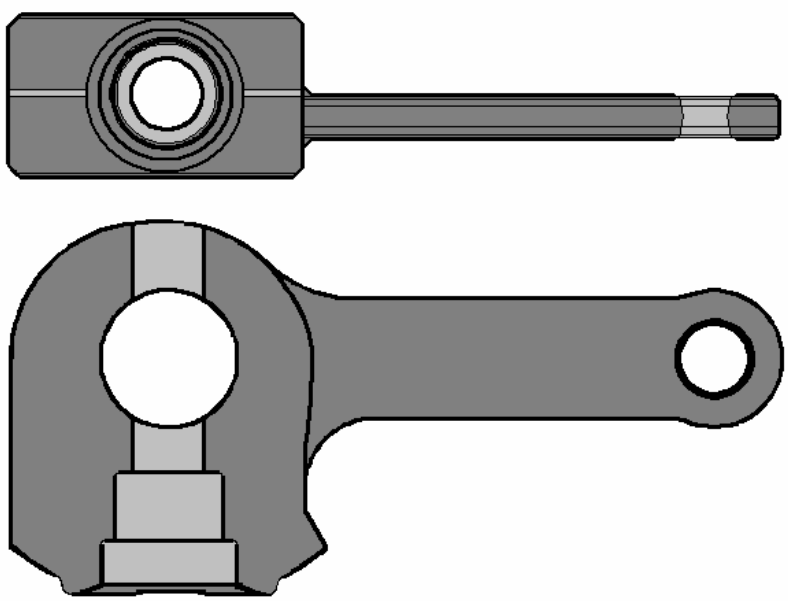


Current Bravo Shift Lever

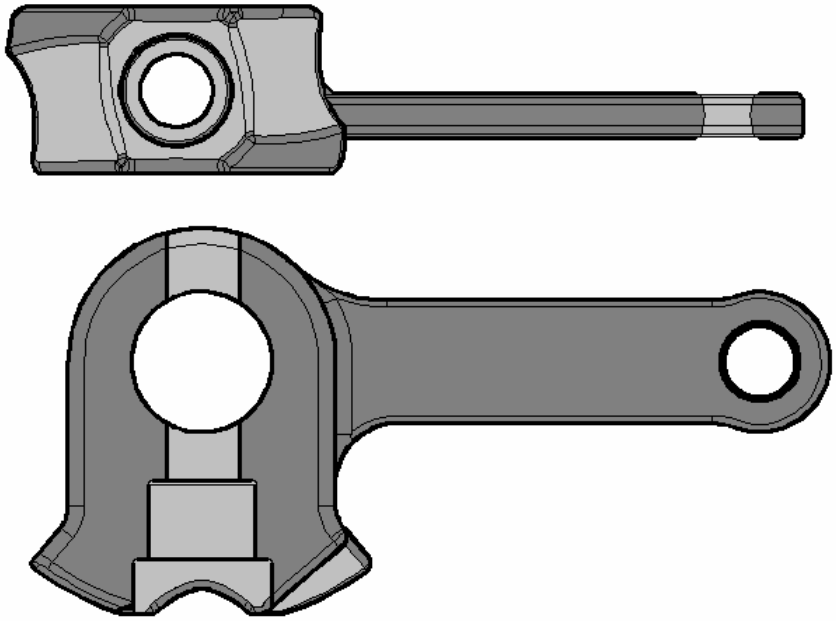


New Design Bravo Shift Lever

Bravo Shift Lever Detent Socket

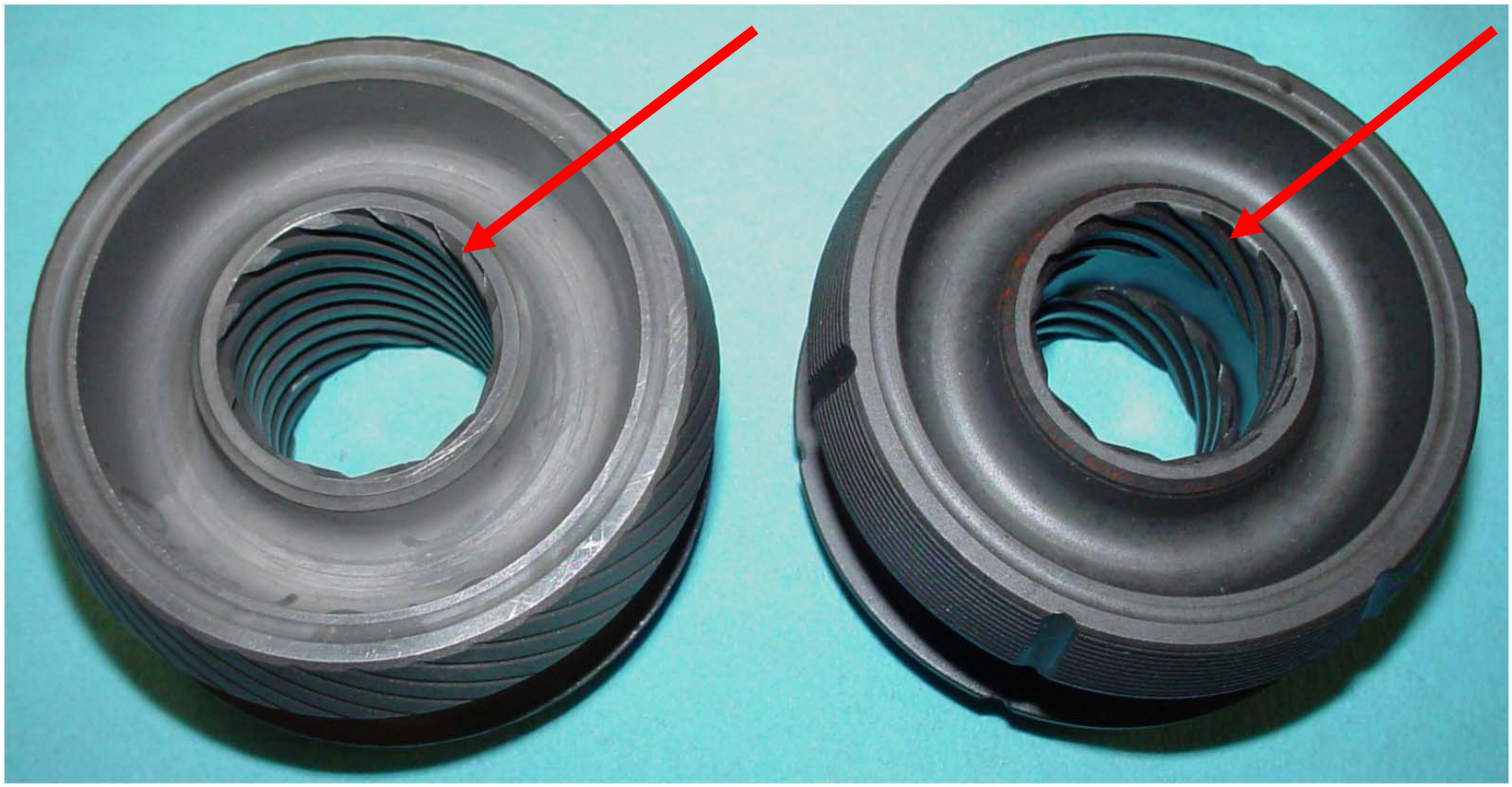


Used in all Bravo X and XR Stern Drives with High Bump Brass Sleeves

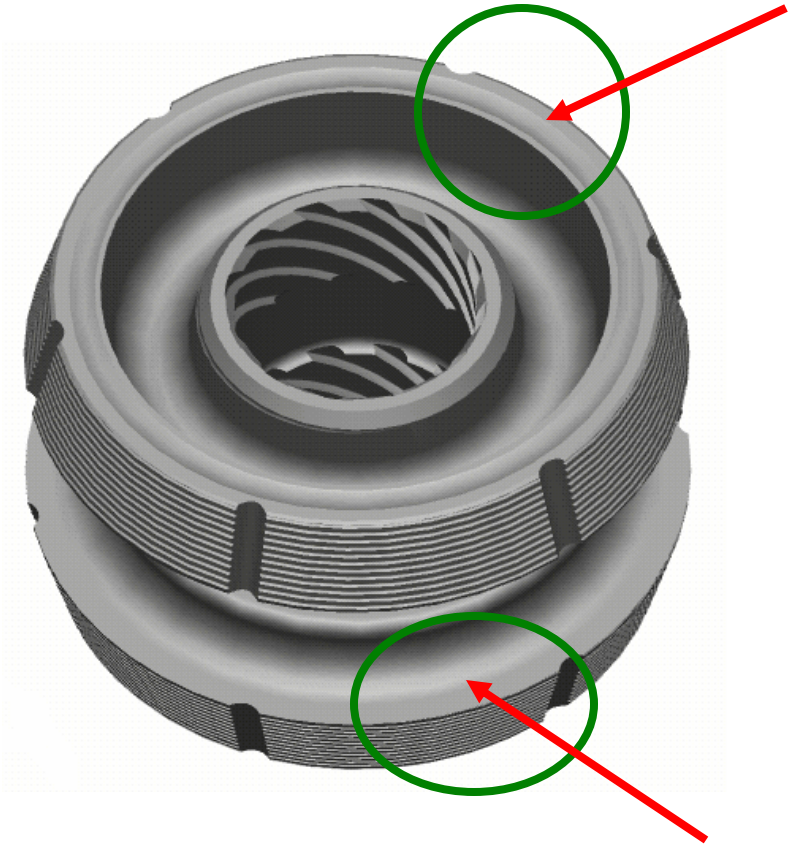


Used in all Standard Bravo Stern Drives with Low Bump Brass Sleeves

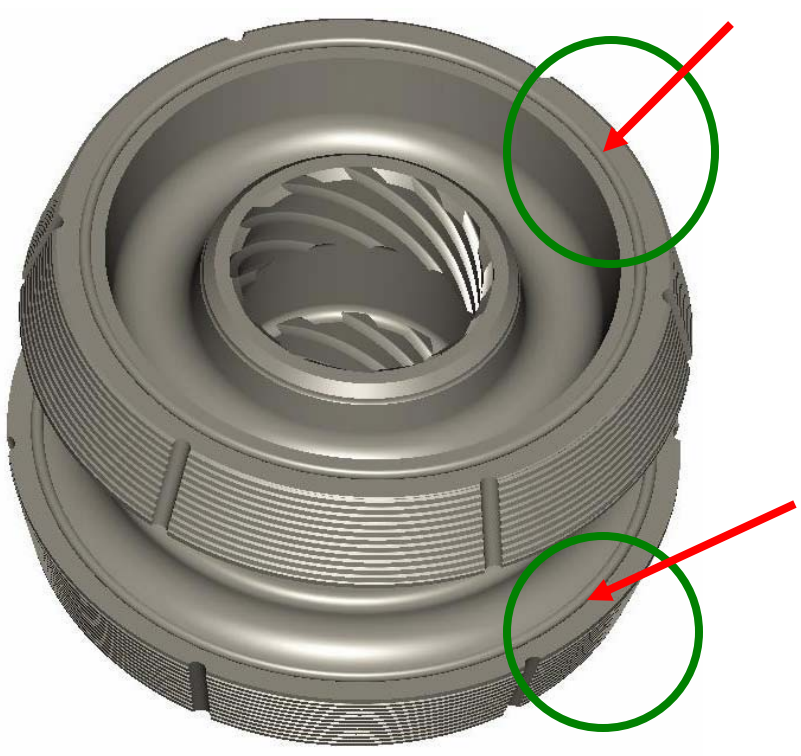
Drive Initiatives – May 2004
Bravo Cone Clutch Redesign



Drive Initiatives – May 2004
Bravo Cone Clutch Redesign



Current Bravo Cone Clutch



New Design Bravo Cone Clutch

Drive Initiatives – May 2004
Bravo Styling

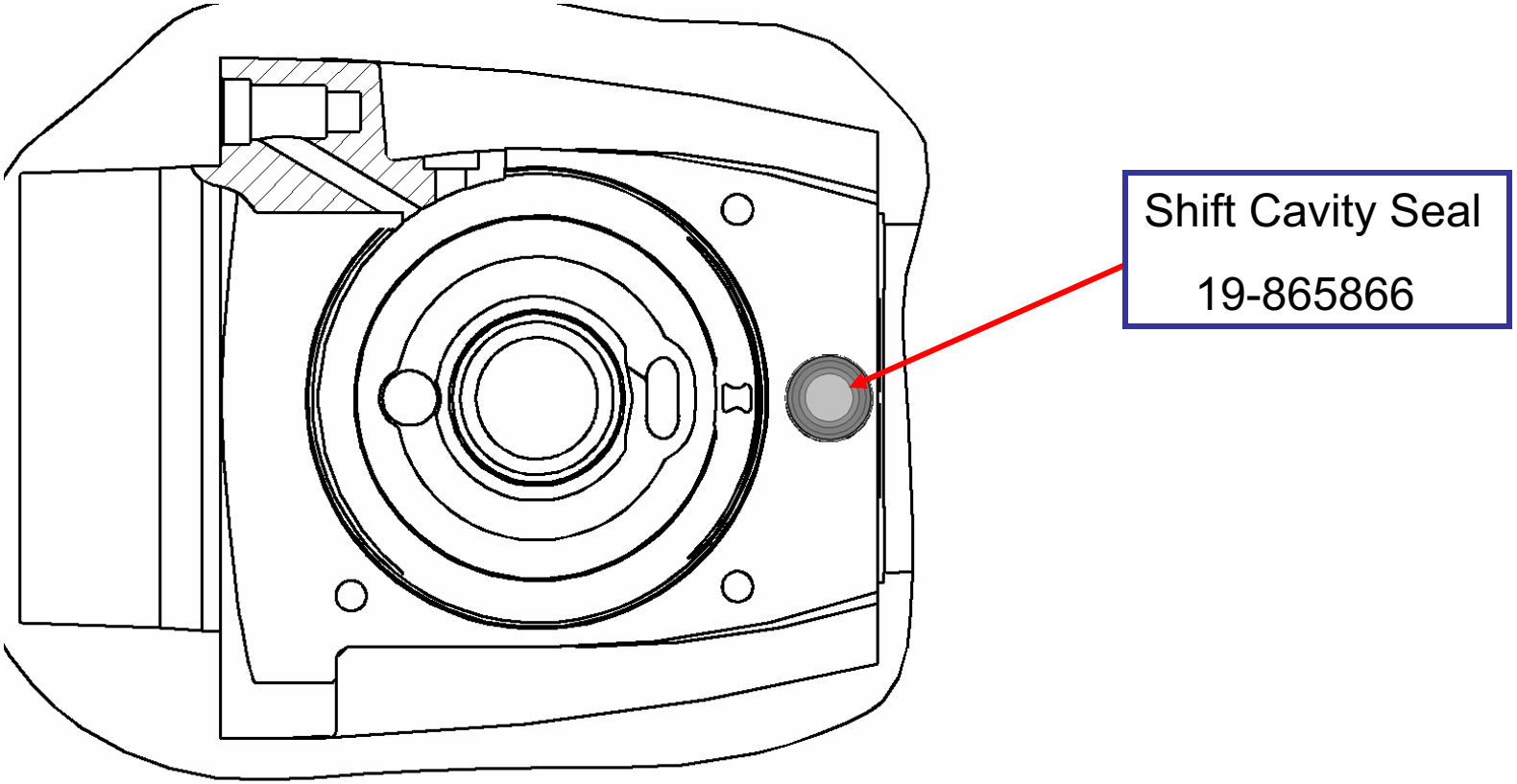
Current Design Bravo

New Design Bravo June 2004

- **Project Definition**
  - **Restyling of**
    - **Upper Driveshaft Housing (DSH)**
    - **Rear Cover**
    - **Top Cover**
    - **Decals**
  - **No external changes to Bravo Drive since 1987**
  - **Affects Bravo Drives only**
- **Benefits**
  - **Enhanced aesthetics to identify the new and improved Bravo Drive**
- **Impact**
  - **External Steering Suppliers may require changes to their components to match DSH changes**
  - **SOP – May 31, 2004**

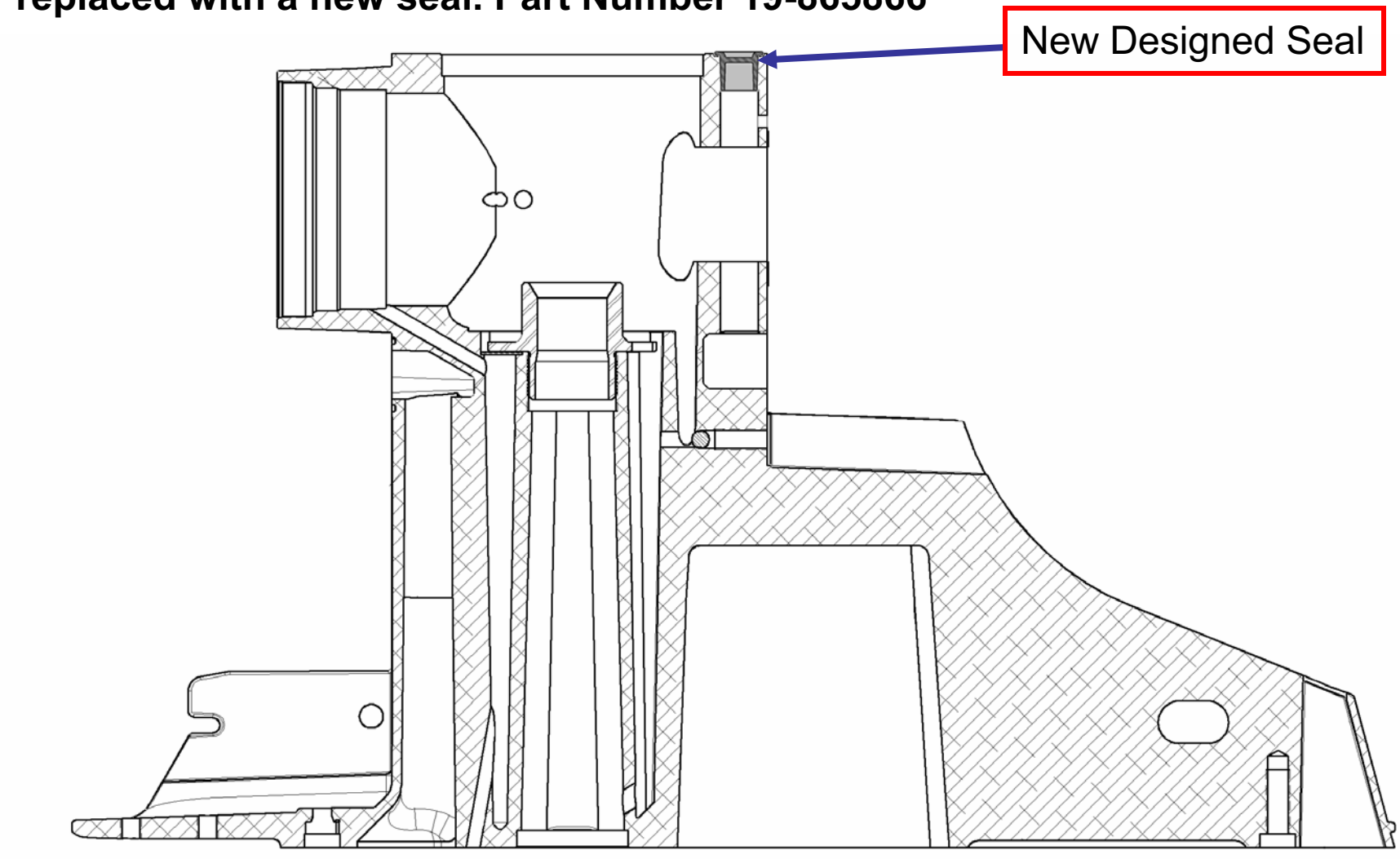
Bravo Drive Shaft Housing

The “O” ring for the drive shaft housing shift shaft bore has been replaced with a new seal.



Bravo Drive Shaft Housing

The “O” ring for the drive shaft housing shift shaft bore has been replaced with a new seal. Part Number 19-865866

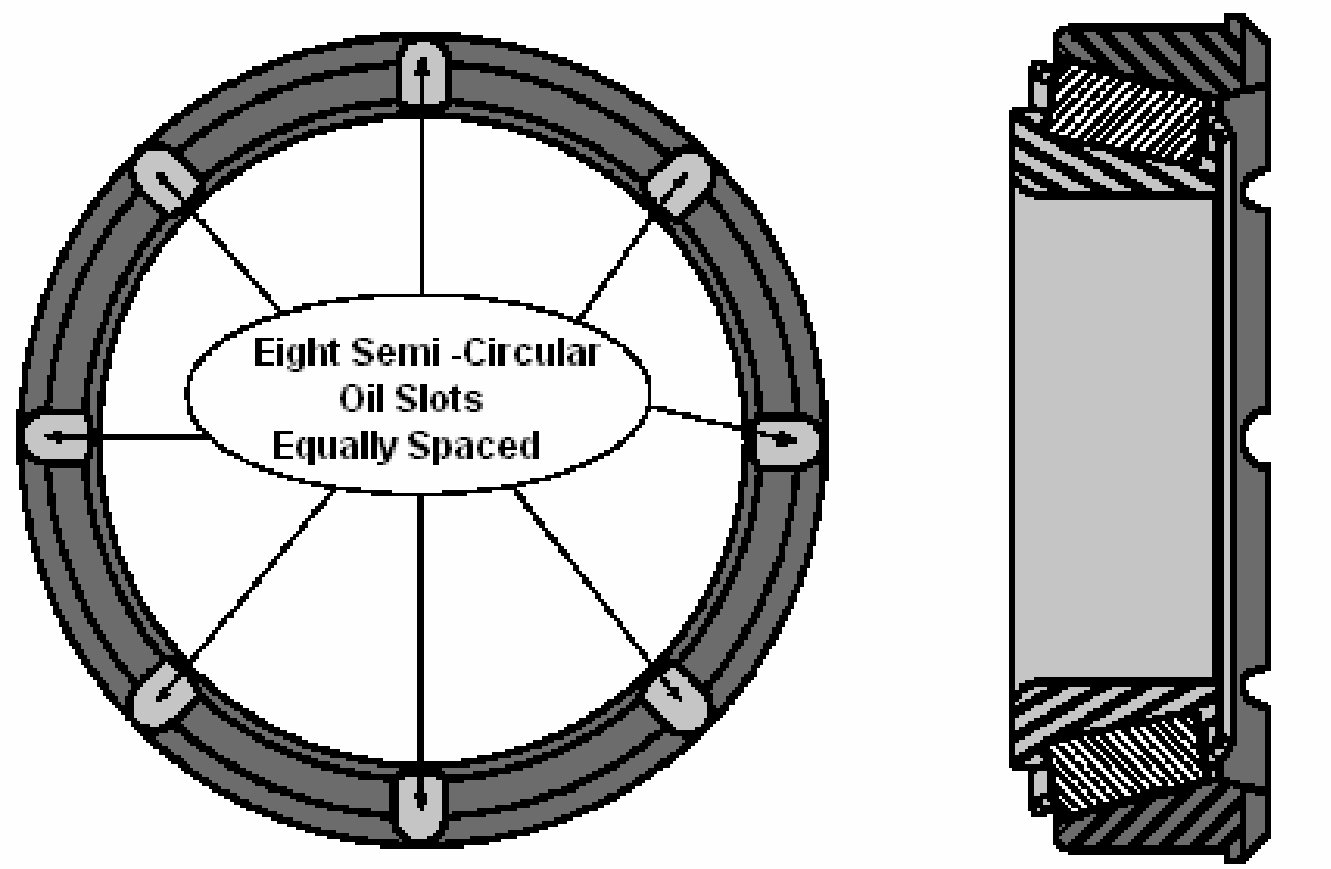


Introducing the New Bravo Jan, 2004 Shimming process

- The Bravo drives for 2004 will have the gears in the drive shaft housing shimmed into position to improve on gear life.
- The Universal joint pinion gear will be shimmed for gear depth.
- The driven gears will be set by checking gear lash.
- There are new shims for the U-joint pinion gear bearing set as well as a new bearing pack to allow shimming to be done.
- The new shims will be placed between the new special bearing cup and the aluminum shoulder in the U-joint snout.
- The new shims will come in 0.001 graduated sizes, starting at (0.71mm) 0.028 through (1.02mm) 0.040 in size.
- The driven gear shims will also come in .001 graduated sizes, starting at (1.47mm) 0.058 through (1.70mm) 0.067.

U-joint and Driven Gear Bearing Spacer Cup for all Bravo Drives

- New U-joint shouldered bearing pack spacer cup and bearing.



U-joint and Driven Gear Shims and Chart

- New U-joint shouldered bearing pack Chart and Shim.

PART NUMBER	"A" DIM
15-888927-028	.028
15-888927-029	.029
15-888927-030	.030
15-888927-031	.031
15-888927-032	.032
15-888927-033	.033
15-888927-034	.034
15-888927-035	.035
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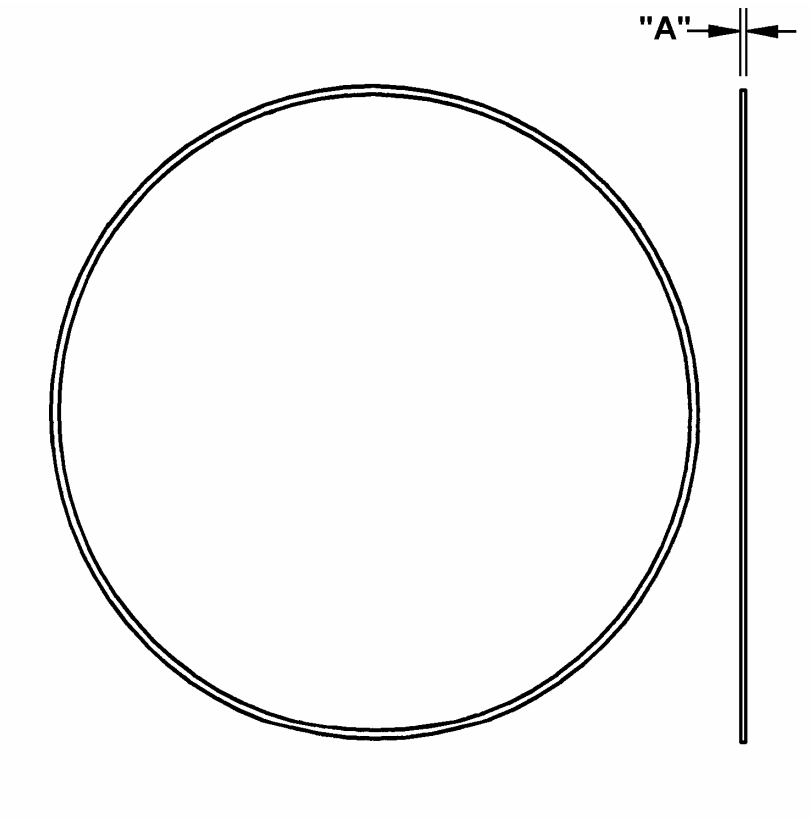
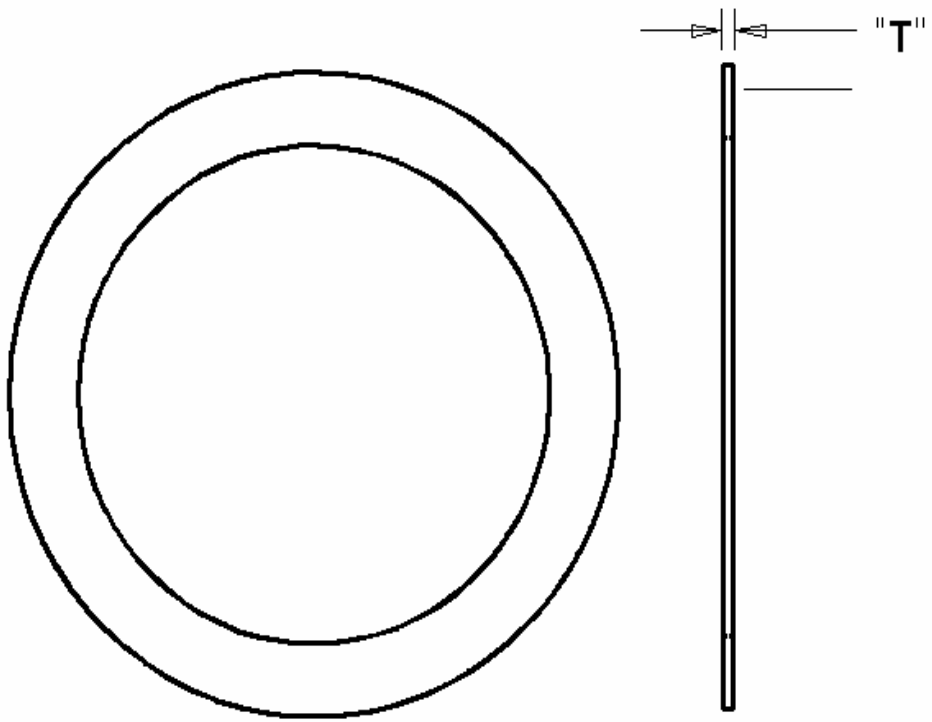
15-888927-037	.037
15-888927-038	.038
15-888927-039	.039
15-888927-040	.040



Bravo 2004 Driven Gear Thrust Bearing Race and Chart

Part No.	"T" MEASURED AT GAGE DIA.	Color Code
23-864596-058	1.47 mm (.058 in.)	BROWN
23-864596-059	1.50 mm (.059 in.)	WHITE
23-864596-060	1.52 mm (.060 in.)	ORANGE
23-864596-061	1.55 mm (.061 in.)	GREEN
23-864596-062	1.57 mm (.062 in.)	YELLOW
23-864596-063	1.60 mm (.063 in.)	RED
23-864596-064	1.63 mm (.064 in.)	LIGHT BLUE
23-864596-065	1.65 mm (.065 in.)	BLACK
23-864596-066	1.68 mm (.066 in.)	PINK
23-864596-067	1.70 mm (.067 in.)	PURPLE

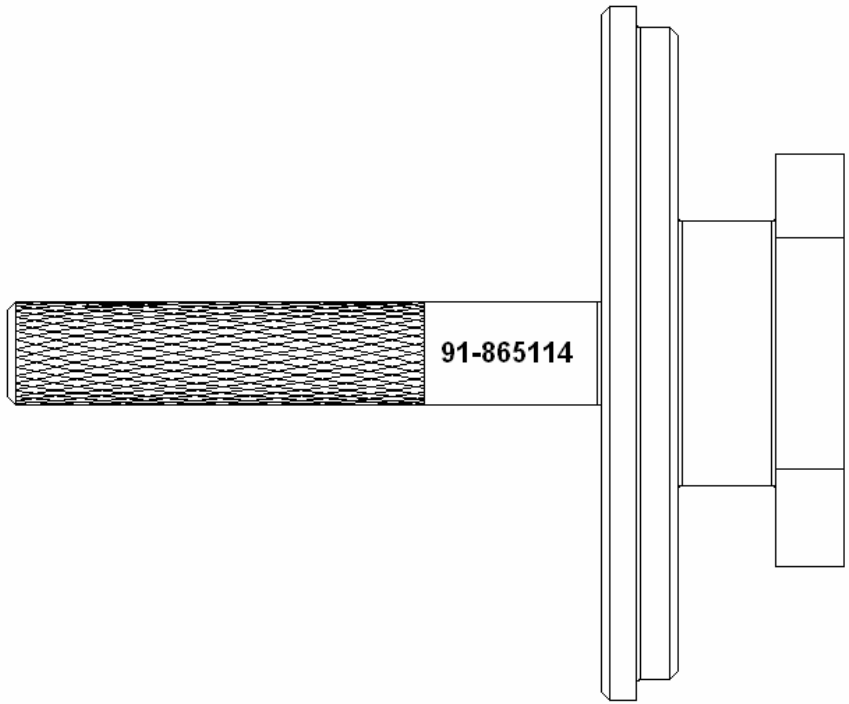


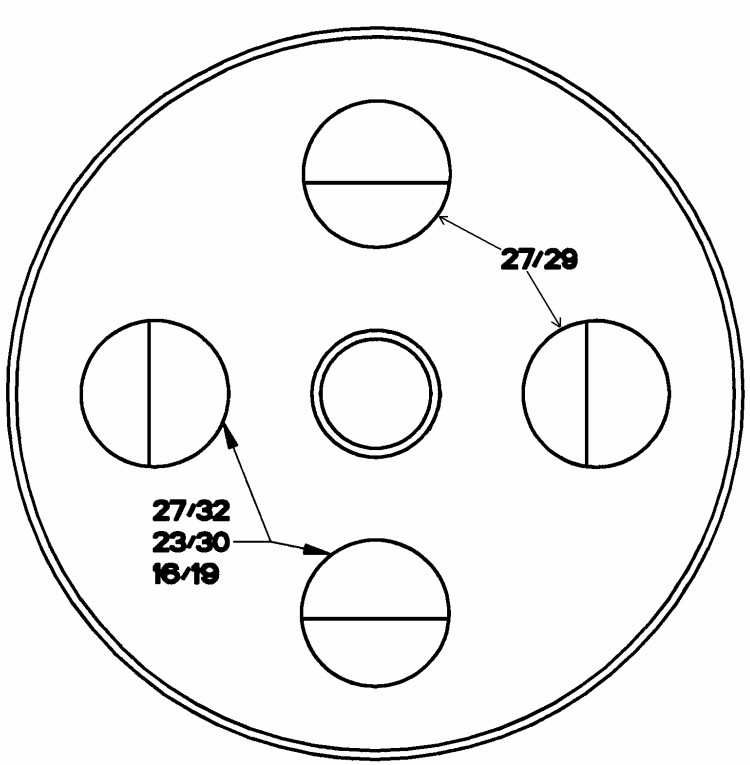
Gear Lash Specification Chart for Bravo 2004

Gear Tooth Count		***Gear Lash***
27 x 32	**Spiral Tooth Gear**	**.011 - .016**
27 x 29	**Spiral Tooth Gear**	**.013 - .018**
23 x 30	**Spiral Tooth Gear**	**.011 - .016**
16 x 19	**Straight Tooth Gear**	**.010 - .015**

New Shimming Tools Required to shim a Bravo Upper

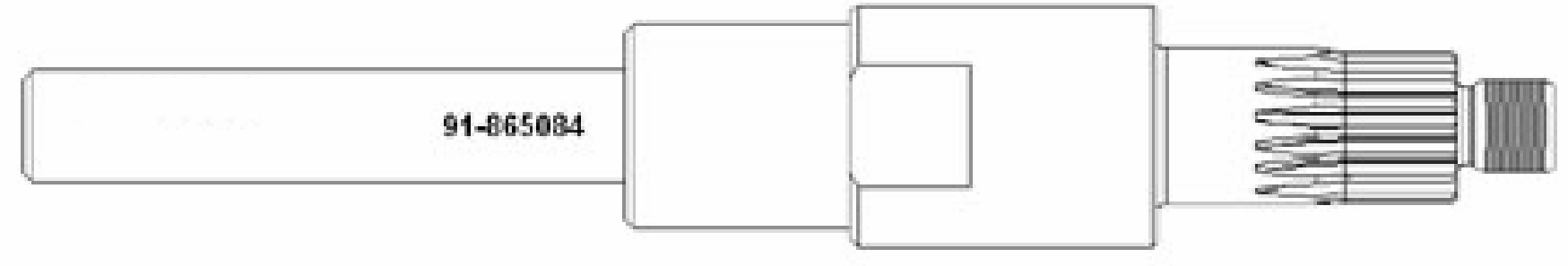
- U-Joint pinion gear shimming tool



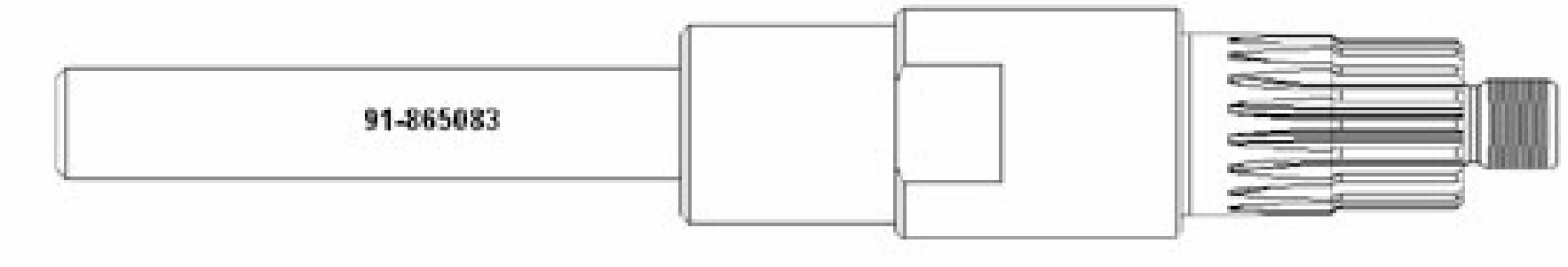


U-Joint pinion gear shaft tools

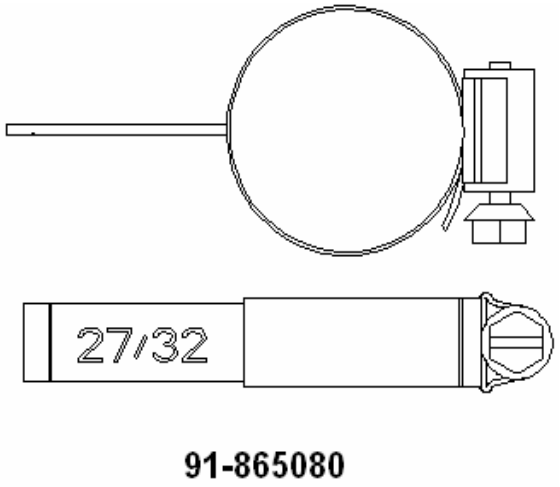
- Standard Bravo



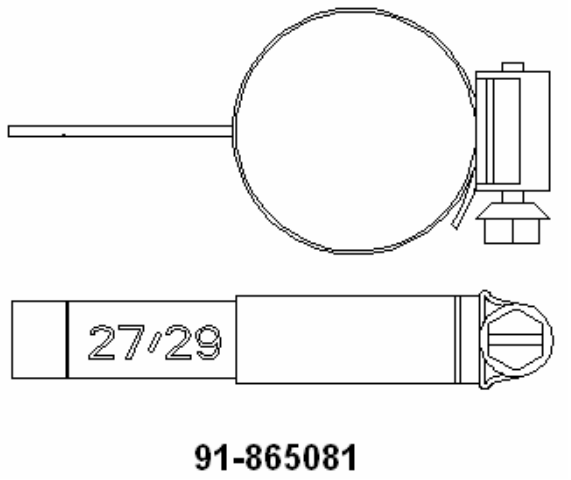
- All Bravo X models



Gear Lash Flags for the new shimming procedure



91-865080



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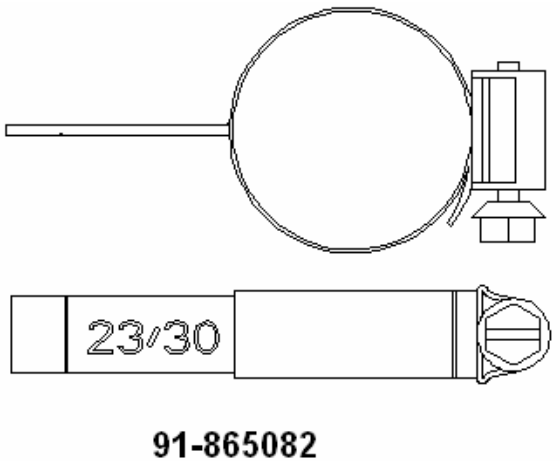
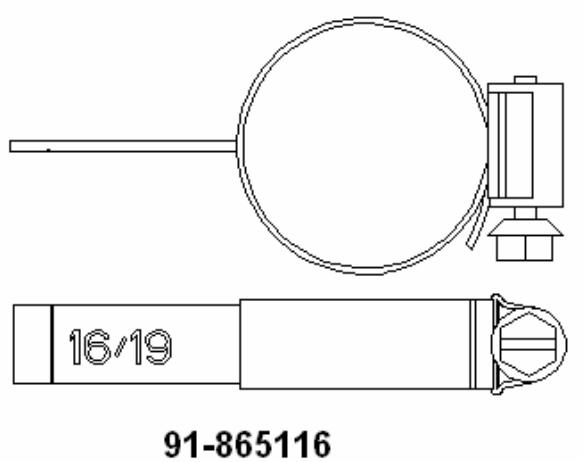


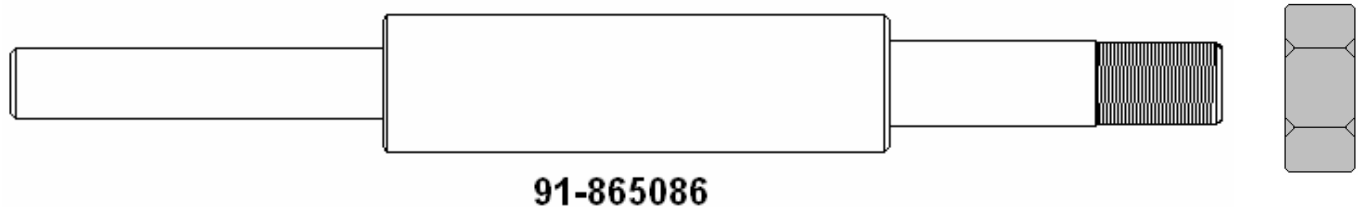
91-865082



91-865116

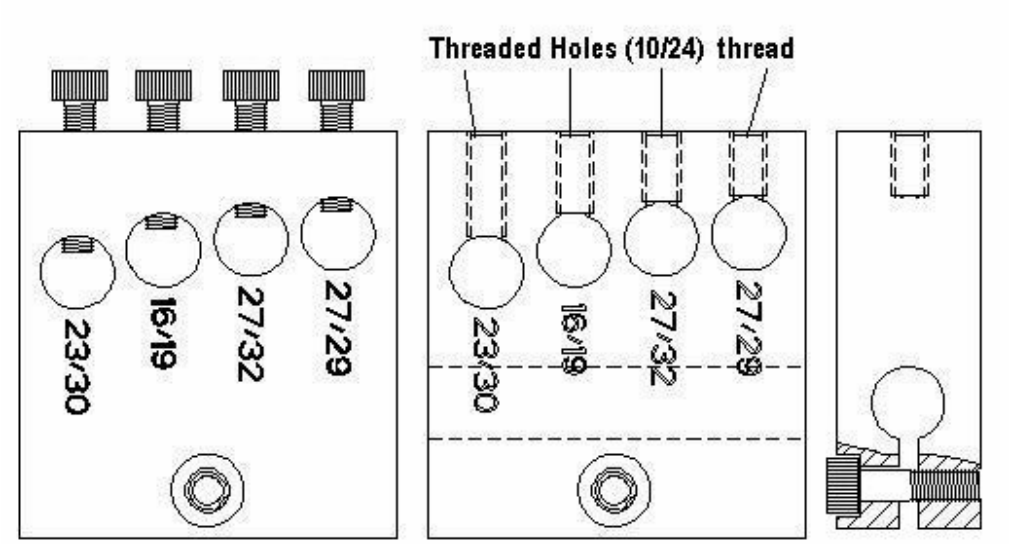
Holding Block and Rod assembly for the Dial Indicator

- **Dial Indicator holder rod and retaining nut.**



91-865086

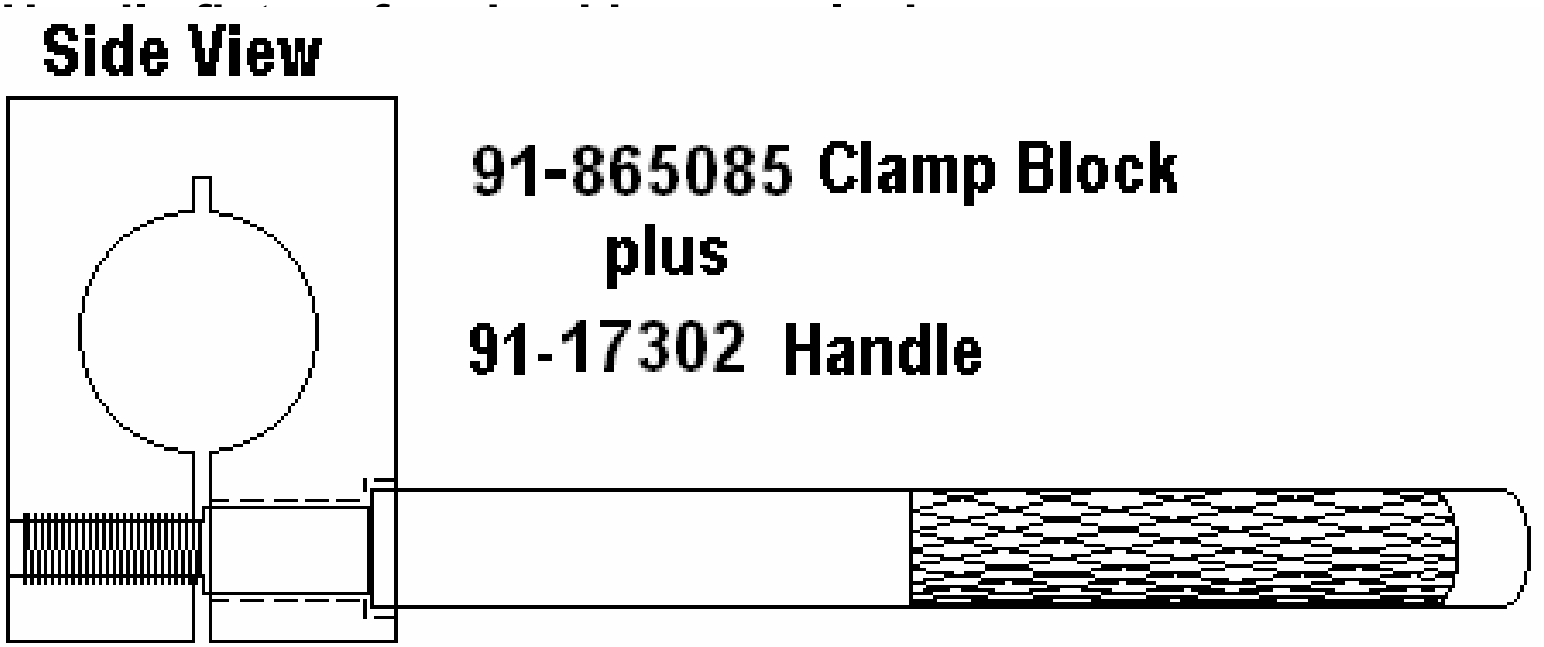
- **Dial Indicator holding block.**



91-865097

Handle Fixture for checking Gear Lash

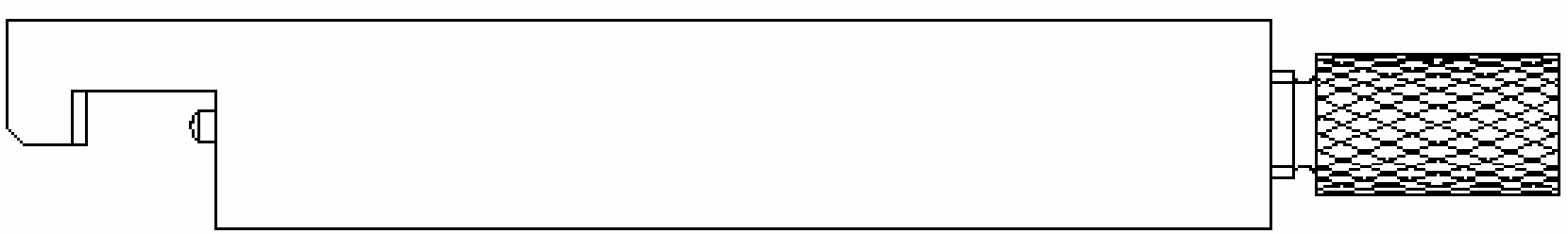
- Side View



91-865085 Clamp Block
plus
91-17302 Handle

Driven Gear Clamp Tool

- Clamp tool to hold driven gear when checking gear lash.



91-865115

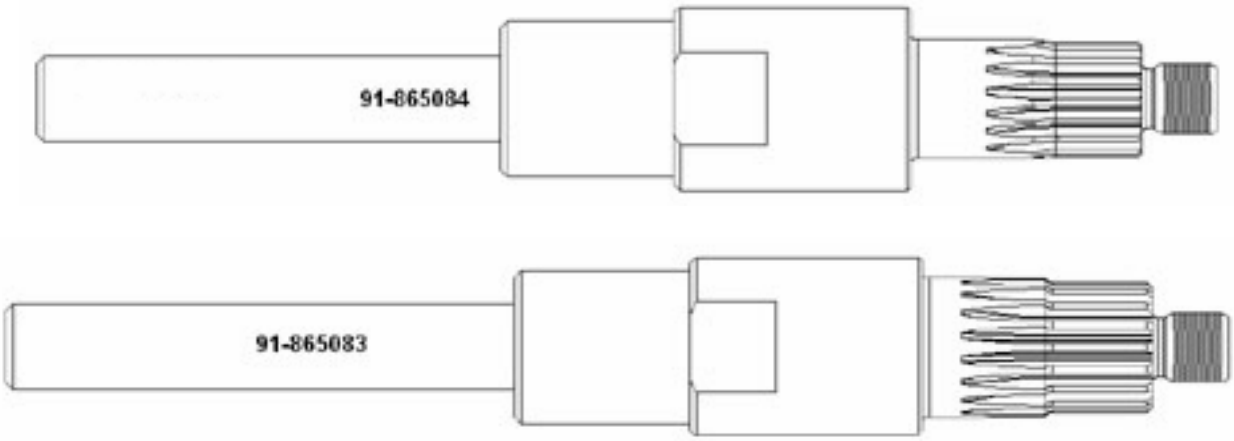
To order the Complete Tool Kit Including both sets of Shims required to Fully Shim the **NEW Bravo Upper Drive Shaft Housing**
Order Tool Kit Part Number **91-865114 A01**

New Shimming procedure for Bravo Upper 2004

- Step 1) Place the new U-Joint bearing pack on to the gear as you have in the past, by pressing the first bearing roller and cone assembly onto the gear until it bottoms on the gear. Next place the bearing cup for that bearing over the cone and roller assembly.
- Step 2) Place the center cup/spacer over the gear and press the second bearing onto the gear until a slight preload is felt. Stop at that point, now place the assembly you just set up over the U-joint along with the large thrust washer and the retainer nut assembly and adjust the bearing preload to (.9 Nm) 8 lb. in. for new bearings and (.6 Nm) 5 lb. In. for used bearings.

New Shimming procedure
(continued)

- Step 3) After the bearing preload is set remove the gear and bearing pack from the U-joint assembly along with the large thrust support washer, place them over the stub shaft tool. 91-865084 for the standard Bravo and 91-865083 for the (X) models and reinstall the pinion nut and washer, (DO NOT) over tighten the pinion nut, just tighten the nut and washer until it feels firmly seated against the gear.

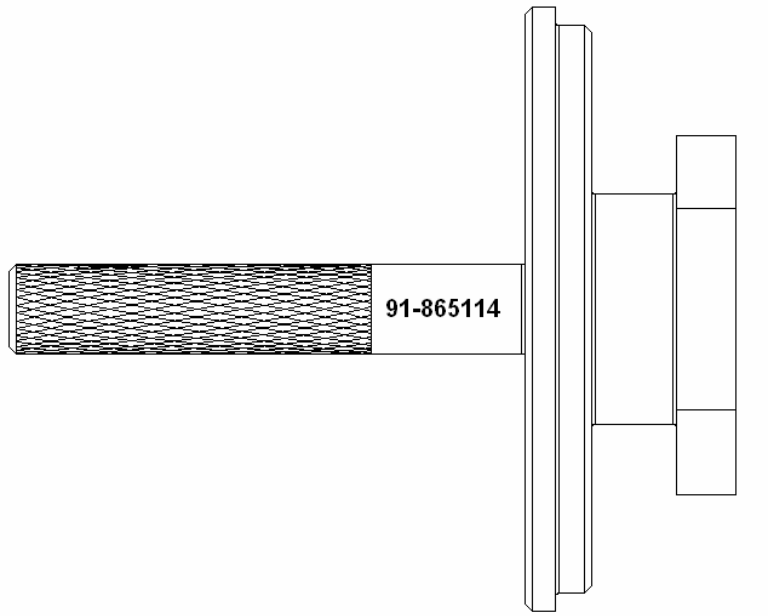


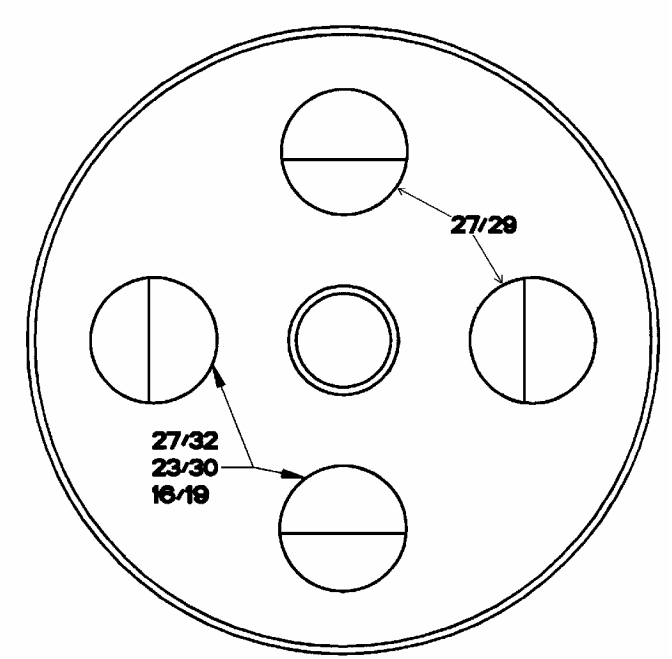
New Shimming procedure
(continued)

- Step 4) In this step you will insert the original shim thickness that came out of the drive or a starting shim of (.089mm) .035 and the U-joint bearing pack and pinion gear on the shaft tool into the housing bore.
- Step 5) Install the U-joint retainer nut and torque to (271Nm) 200 lb. ft. (use the reference chart for the actual torque that must be applied per the length of the torque wrench being used).

New Shimming procedure
(continued)

- Step 6) Insert Pinion gear shimming tool 91-865114 into the top of the driveshaft housing using the proper gear tooth count for the gear ratio of the unit being worked on.



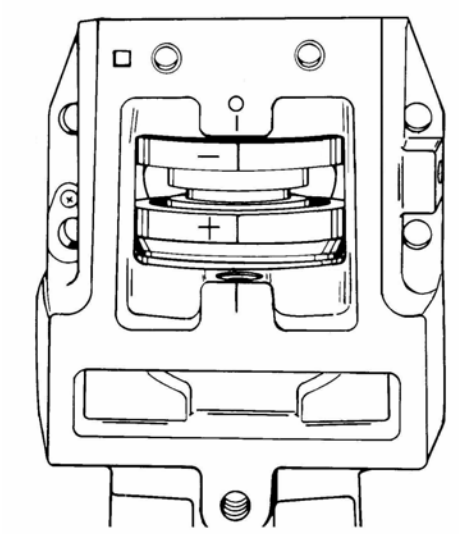


New Shimming procedure (continued)

- Step 7) Using a feeler gauge between the tool face and the gear teeth measure for the (0.64mm) .025 distance between the gear teeth and the face of the shimming tool. If a change is required the shims come in (.0254mm) .001 increments. Make the changes and recheck for the (0.64mm) .025 distance between the gear teeth and the face of the tool.
- Step 8) Next loosen the U-joint assembly retainer nut and remove the gear and bearing assembly, using caution to prevent damaging the shims in the snout.
- Step 9) You now will place a (1.62mm) .064 shim race thickness as a starting point into the drive unit under the driven gear or the original shim race that was removed when the unit was disassembled.
- Step 10) Now install the driven gear set and the thrust bearing into the housing.

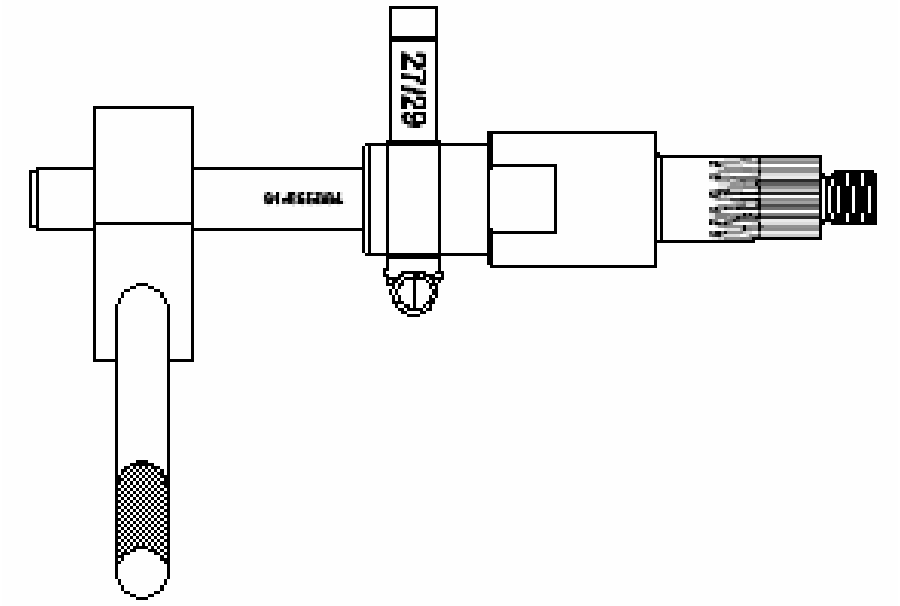
New Shimming procedure
(continued)

- Step 11) Place the thrust bearing on the top gear along with the shim race (thickness that was originally removed) or a (1.62mm) .064 starting point shim race, install the top cover and torque to (27Nm) 20 lb. ft.
- Step 12) Making sure that the gears are lined up (+) plus over (-) minus and the gears are in the proper position with the marks on the back of the driveshaft housing.



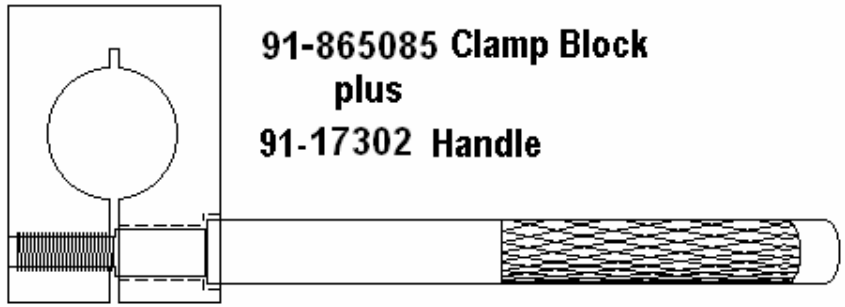
New Shimming procedure
(continued)

- Step 13) Reinstall the U-joint gear and bearing pack with the stub shaft tool that you previously removed and retorque the retainer nut to (271 Nm) 200 lb. ft.
- Step 14) Next you will place the proper gear lash flag per the gear ratio of the drive, onto the stub of the shaft that you just installed with the U-joint pinion gear and bearing pack.



New Shimming procedure
(continued)

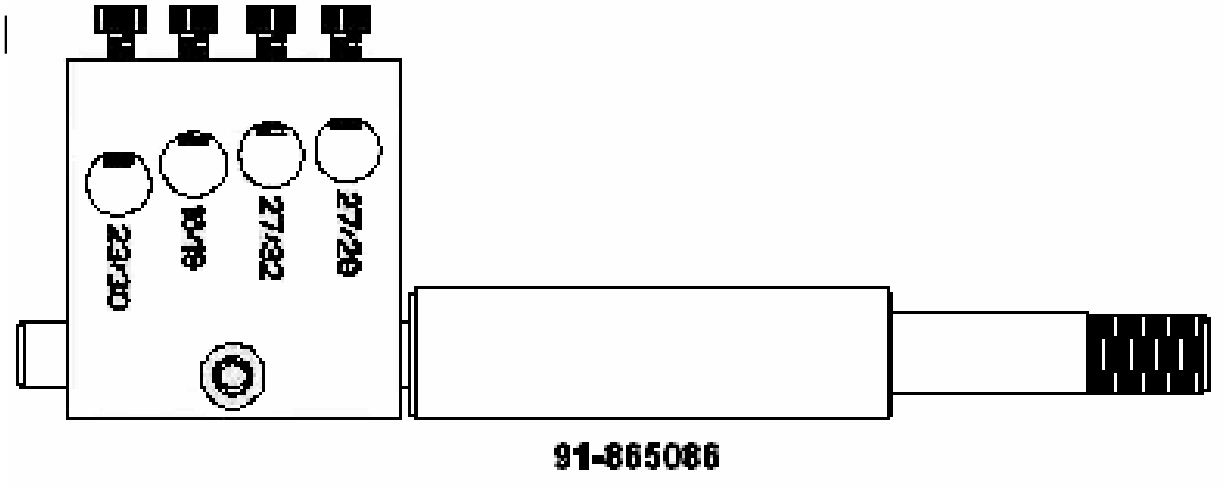
- Step 15) The next step will be to install the clamp block and handle assembly onto the end of the U-joint stub tool on the Pinion gear y at this point, just enou of the shaft.



- Step 16) Now install the dial indicator holder rod into the top stud hole of the driveshaft housing and tighten the nut.

New Shimming procedure
(continued)

- Step 17) The next step will be to install the dial indicator holding



- Step 18) Install the dial indicator into the holding tool and lock it in place with the screw in the tool, using caution not to tighten the screw to tight causing it to bind the indicator movement.

New Shimming procedure
(continued)

- Step 19) Next align the Gear Lash Flag perfectly straight up and down on the bearing and pinion gear stub shaft.

- Step 20) Move the dial indicator holding tool to align the dial indicator tip 90° perpendicular to the gear lash flag at the hash mark on the flag.

- Step 21) Install the clamp tool onto the bottom driven gear in the drive shaft housing, making sure that it is over to one side of the drive shaft housing so you can hold the driven gear from n

91-865115

New Shimming procedure
(continued)

- Step 22) Now tighten the clamp block on the stub shaft locking it to the shaft.
- Step 23) While holding the driven gear in a locked position with the clamp tool, you will now check the amount of gear lash you have on this gear to the pinion gear, it must be from .000 to .000 if the lash is more than the high limit per the lash chart you will have to change the shim race to a thicker race, making sure you record the gear lash reading, Do not make any changes at this time.
  The shim races will change by (.0254) .001 in. in thickness. (example for a (1.60mm) .063 the next thicker shim race will be a (1.62mm) .064 and etc.) from (1.47mm) .058 though (1.68mm) .066. The change should be a one to one match.
- Step 24) You now have to remove the clamp tool from the bottom gear and change it to the top gear and repeat steps 21 and 22 performed previously.

New Shimming procedure
(continued)

- Step 25) In this step you will make the required shim race changes and redo the process, by first removing the dial indicator from the holding block, loosen the lash flag and remove it from the stub shaft, next remove the dial indicator rod to make room for the spanner wrench so you can remove the pinion gear and bearing pack from the housing. Taking care not to damage the pinion gear shims in the snout.
- Step 26) Remove the top cover.
- Step 27) Next remove the driven gear pack and make the proper changes for the shim race under the bottom gear first, then reinstall the driven gear pack aligning the (+) plus over (-) minus on the brass sleeve to the hash marks on the housing and make the proper shim race change for the top gear, then reinstall the top cover and torque to specifications.
- Step 28) To recheck your work repeat the process following steps 8 through 22.

New Shimming procedure (continued)

- Step 29) After the gear lash process is complete and the drive is ready to reassemble for the final time, remove the U-joint stub yoke shaft assembly and remove the pinion gear and bearing pack assembly.
- Step 30) Reassemble the U-joint assembly as follows, first place the retainer nut over the stub yoke, then place the seal carrier along with the “L” washer on the standard Bravo as well as the “O” ring and the large thrust washer now before you place the pinion gear and the bearing pack onto the shaft you will have to back off the bearing preload so when you place the gear and bearing pack onto the splined stub yoke, the preload can be reset to the same Inch pounds you started with.

MERCURY
MerCruiser

2005

Product Update

Section 6

6

Customer Satisfaction Index (CSI)

Notes:

Table of Contents

CSI Info and FAQ
Customer Satisfaction Index (CSI)
Frequently Asked Questions
Sample of Card

Notes

CSI Info and FAQ

Customer Satisfaction Index (CSI)

Customer Satisfaction Index (CSI) Getting your finger on the pulse of your customer. People spend a lot of energy trying to make customers happy. Money spent for advertising, new and different merchandise, boat shows, open houses, training, and special programs. Staffing for peak customer traffic times or extending service department hours. Always trying to provide ourselves with something that the customer wants that will make them your customers instead of the competition's customer.

How do we determine what that competitive advantage is? First you have to identify what your strengths are. What is it that your service department does that your customers really like and keeps them coming back? When we identify what those items are we can build on those strengths. We also need to identify what our opportunities for improvement are. What do our customers feel that we could do to better serve them and make them want to come back to our service department?

What better way to gain this kind of insight than to ask the customers themselves? As any technician will tell you, a big part of being successful in service is having the right tools for the job. These tools range from wrenches, screwdrivers, and special tools to computer diagnostic equipment. All of those tools won't help us if we do not understand what we need to fix? So we need reference manuals and we need to ask questions. We are going to reach in to the tool box today to pull out some very important reference materials. The Consumer Survey Index (CSI). CSI is just like any other tool. If you never take it out of the box it cannot help you. The CSI reports for your dealership are readily available on MercNET for your review and are broken down into four easy to use categories. We will provide you with a brief overview of the CSI program, answer some of the most frequently asked questions regarding CSI and show you how easy it is to gain access to your individual CSI report.

Program Overview

Mercury Marine's Dealer Warranty Service CSI program is designed to help dealers understand how they are doing relative to customer's perceptions. The goal of this program is to measure the satisfaction level of consumers who have had Mercury engine warranty work performed at a Mercury Authorized dealership. The results are then provided to each dealership to assist in recognizing the customer's perception of their dealership.

Frequently Asked Questions

Why is CSI important?

- CSI shows customers that we care about them.
- They communicate whether our customers are happy with our products or services.
- They tell us if we are providing the goods or services that they want.
- The survey can provide us a valuable opportunity to correct an oversight or miscommunication with a customer.
- They can indicate how profitable your dealership will be.

How is the CSI survey generated?

A CSI survey is sent out to the consumer two weeks after receipt of a Mercury Outboard, Sterndrive, or Inboard warranty claim is submitted by the servicing dealer. A consumer will only receive one survey in a three month time period for the same serial number (regardless of how many claims are submitted for that serial number).

What question(s) are used to determine a dealer's CSI score?

Only one question is used to determine the overall service CSI score. The question is "Overall, how satisfied were you with your service experience?"

How can a dealer check their overall CSI score?

Dealer CSI reports are available on MercNET. After logging into MercNET, a dealer should look under the "Service" heading for the "CSI Score/Service Rates" link. This will take the dealer to the CSI Score/Service Rates summary page. Dealers can then view detailed reports by clicking on the "Detailed Dealer CSI Report" link on the top left hand of the screen.

When is the CSI information updated?

The CSI information is updated on a quarterly basis approximately four weeks after the quarter ends. For example first quarter data would be updated and available approximately the fourth week of April.

What timeframe is used to determine a dealer overall CSI score?

A dealer CSI score is calculated on a quarterly and 12-month rolling basis. The overall CSI score is based on the 12-month rolling average.

Notes

Notes

What is a “Hot Alert” and how is it generated?

A Hot Alert is a faxed notification to a dealer that a consumer has returned a survey in which they indicated their engine problems / service issues were not resolved by the dealer and or their engine problems / service issues were not resolved to their satisfaction by the dealer.

How does the “Hot Alert” affect a dealer’s CSI score?

A Hot Alert does not directly affect a dealer’s CSI score. As stated above, a dealer’s overall Service CSI score is determined by the score of the question “Overall how satisfied were you with your service experience?” A consumer may mark “Very Satisfied” in response to this question and indicate that their issue is unresolved in the surevy. This would generate a “Hot Alert” that would then be faxed to the dealer for follow-up.

What is the “Hot Alert Postcard” that consumers receive?

10 days after a Hot Alert is sent to a dealer, Mercury sends out a postcard to the consumer on the Hot Alert. This postcard indicates that Mercury has contacted the dealer and asked them to get in touch with the consumer. The postcard also provides the Customer Service telephone number on the postcard in case the issue has not yet been addressed or resolved by the dealer.

If a dealer has questions on their CSI score or about the program, who should they contact?

Dealers can contact their Mercury Marine Technical Account Manager (TAM) or Chuck Willems at (920) 929-5019 or at chuck_willems@mercmarine.com.

The Mercury CSI surveys are only sent out to customers which have a warranty repair performed. How can I reach my other customers and gather this type of valuable information?

There are many ways you can access your customers for post-contact information ranging from in-house or third party telephone follow-up programs to personalized letters. In response to your inquiries Mercury Marine has developed a new way and revised an old standby to assist you in this regard.

First, we have developed a couple of form letters in which you can insert your company and customer information and or tailor the content to your specific needs. These follow-up form letters will be available on MercNET in the summer of 2004 and will be in MSWord documents to provide easy access.

The second is a time-tested, easy to use and cost effective method - **Customer Satisfaction Survey Cards**. For several years Mercury Marine offered Customer Satisfaction Survey Cards, **(P/N 90-821218)**, to dealers at no cost to provide you the opportunity to get some direct feedback from your service customers. Having a customer service follow-up system in place is one of the best ways to keep customers satisfied and improve your CSI score! Last year we solicited dealer feedback to update and release the revised card!

CUSTOMER SATISFACTION SURVEY

Dear Valued Customer,

We would like to ask you a few questions regarding your last Service visit to our Dealership. We appreciate your business and your responses today will allow us to better serve your needs in the future.

	YES	NO
When you arrived at our store was our staff professional and courteous?	☐	☐
Were your service request(s) completed satisfactorily?	☐	☐
After repairs were completed were all related charges explained fully?	☐	☐

If you answered NO to any of the above questions, please tell us why: _____

_____

_____

	Definitely	Probably	Might or Might Not	Probably Not	Definitely Not
Based on this service experience, would you recommend our Service Dept. to a friend or relative?	☐	☐	☐	☐	☐

Your satisfaction is important to us! Please return the completed post card or call us if you wish to discuss your experience. Thank you for your continued patronage.

90-821218 2-204

_____

_____

_____

Customer's Return Address

PLACE POSTAGE HERE

SAMPLE

Customer Satisfaction Survey

DEALER'S NAME and ADDRESS

CUSTOMER SATISFACTION SURVEY

Dear Valued Customer,

We would like to ask you a few questions regarding your last Service visit to our Dealership. We appreciate your business and your responses today will allow us to better serve your needs in the future.

	YES	NO
When you arrived at our store was our staff professional and courteous?	☐	☐
Were your service request(s) completed satisfactorily?	☐	☐
After repairs were completed were all related charges explained fully?	☐	☐

If you answered NO to any of the above questions, please tell us why: _____

_____

_____

	Definitely	Probably	Might or Might Not	Probably Not	Definitely Not
Based on this service experience, would you recommend our Service Dept. to a friend or relative?	☐	☐	☐	☐	☐

Your satisfaction is important to us! Please return the completed post card or call us if you wish to discuss your experience. Thank you for your continued patronage.

90-821218 2-204

_____

_____

_____

Customer's Return Address

PLACE POSTAGE HERE

SAMPLE

Customer Satisfaction Survey

DEALER'S NAME and ADDRESS

Notes

Dealers have found this card useful for several reasons:

1) The card allows you the opportunity to gain insight from each and every customer by way of an internal survey.
2) The card affords another opportunity for a positive interaction with the customer and your service personnel and 3) the card reinforces your position that you CARE about the customer and their opinion of your service. The card is not brand or marine specific which allows you to use the card for all of the products and brands that you service. It provides you an opportunity to gain valuable insight toward improving the retail customer's service experience while effectively managing costs!

   The survey information has been updated to coincide with three major areas that affect your Mercury Dealer Service CSI reports: Your Personnel, your Service Technicians and your Procedures. The survey was kept simple and easy to complete providing space for comments if the customer answered "no" to any of the questions. Finally, the card then asks the all important question, "Based on this service experience, would you recommend our Service Department to a friend or relative?" The final statement on the card reinforces the importance of the customer and the service relationship by asking them to return the card or call you to discuss their experience and thanking them for their business. This is still the lowest cost way for you to solicit feedback from your service customer. Just hand the customer the card with their copy of the service repair order at the time you re-deliver their boat or leave it in the boat after an in-water service call advising them that you would appreciate them taking the time to fill it out and return it because the information is important to you. This way no mailing costs are involved to get it to the customer and dealership personnel are not using valuable shop time creating after the fact mailings or performing costly telephone surveys. The part number remained the same (90-821218) and can be ordered on your regular P&A order in quantities of 50 at no cost to you.